ELECTRICAL REVIEW

[ILLUSTRATED]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE, TELEGRAPH AND SCIENTIFIC PROGRESS.

(Formerly Review of Telegraph and Telephone.)

Vol. 4, No. 24. WEEKLY. NEW YORK, SATURDAY, AUGUST 16, 1884. $3 per annum. Single Copies, 10 Cents.

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Entered at Post Office, New York, as Mail Matter of the Second Class.

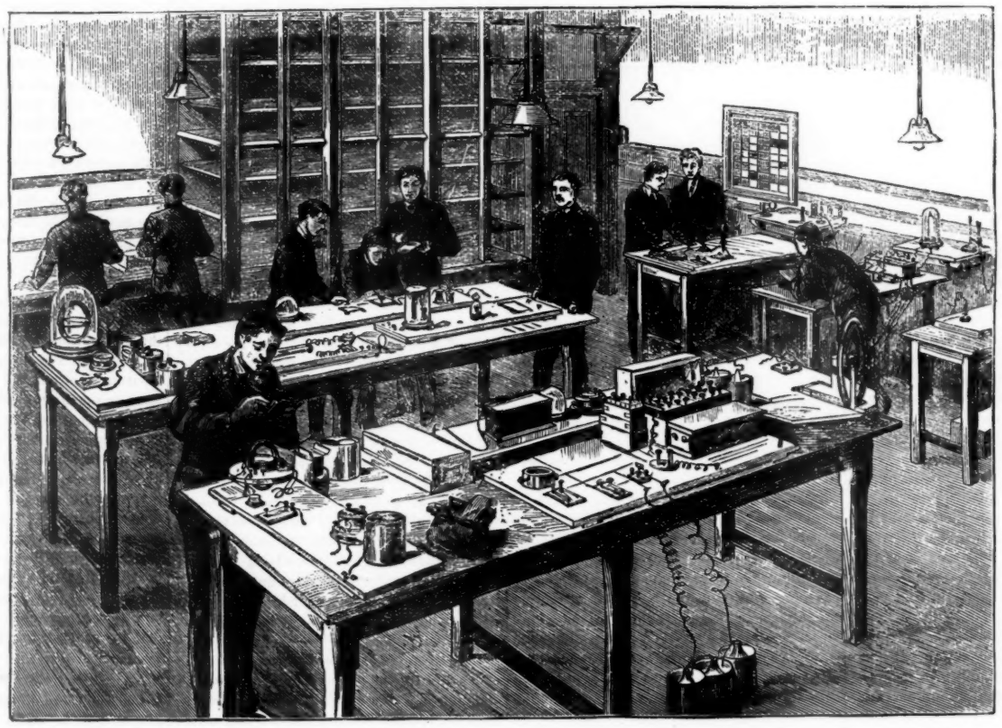
Finsbury Technical College.

From a pamphlet describing the work of the City and Guilds Institute, written for the opening of the Central Institution, in Kensington, by Mr. Philip Magnus, we now give an extract, which details the work done at the Technical College, Finsbury, E. C., and at the same time publish an illustration of one of the laboratories at that college, which we think will interest our readers.

Less than two years after the foundation stone was laid, the new college in Tabernacle Row was opened. The building was erected by Messrs. Peto Brothers from designs furnished by the architect, Mr. E. N. Clifton, under whose direction it was completed. Including the expense of fitting and furnishing the laboratories and workshops, the building has cost over £35,000, towards which sum the Drapers' Company contributed £10,000. The structure is very simple, without ornamentation of any kind. It consists of three stories beside the basement. On the ground floor, to the left of the entrance, are two rooms belonging to the Physical Department, under the direction of Professor Ayrton, used for delicate measuring experiments in telegraphy, etc. In the rear, looking into the playground of the Cowper Street schools, is a large room used for brewing and for experiments requiring the use of steam in organic chemistry; and adjoining this room is a physical laboratory, for experiments in heat. A small class-room for general purposes, and a workshop for the preparation of physical instruments, are on the same floor. The staircase is in the centre of the building, and lighted from the top, and is surrounded on all sides by class-rooms and laboratories. On the first floor are two lecture rooms, each capable of accommodating 200 students—one being used mainly for lectures in chemistry, and the other for lectures in physics and mechanics. The physical lecture room communicates with a large and lofty museum of physical apparatus, and adjoining this are two other laboratories. These rooms are arranged for the carrying on of an organized series of experiments in current and in statical electricity. The peculiarity of the method adopted is that each experiment has all the apparatus required for performing it ready in position, together with printed instructions. The students work in groups of three, as shown in the engraving.

The instruments needed for each experiment are mounted on a board, which can be taken to the lecture-room for use during the lecture. Examples of such arrangements of apparatus are now on view in the exhibition. Adjoining these rooms is a small apartment fitted up with drawing tables, in which the students plot out curves, and record the results of their experiments on square paper. The second floor is mainly occupied by the chemical laboratories. The main laboratory has ninety-six working places, each of which has two drawers and two cupboards, and is available for two students working at different times. Each bench is covered with a hood, at the top of which are openings at intervals connected with the chimney, in which a draft is produced by the waste heat from the boilers, the flues passing down the benches and along the floor. The laboratory is divided by double glass screens, between which are the arrangements for the supply of sulphuretted hydrogen for the use of students. Plans for the laboratory fittings are exhibited in the corridors of the second floor of the Central Institution. Besides the professors' and assistants' rooms, there is a class-room, a balance-room, two store-rooms, and a laboratory for advanced students on the same floor. The instruction, which is under the direction of Professor Armstrong, and will remain under his charge until the opening of the Central Institution in January next, is somewhat different from that of most chemical schools, the object in view being to teach the main facts and principles of chemistry, and to lead the students to observe correctly, and to reason from experiment, rather than to make them highly proficient analysts. Indeed, the teaching of analysis, as in ordinary schools, is a very unimportant feature in the earlier part of the course.

In the basement of the building is a large room which contains dynamo machines, worked either by the main steam engine or by the gas engine in the same room. The greater part of the building is lighted by incandescent lamps, which are supplied with a current from an Edison dynamo machine in this room. Another room in the basement is fitted up as a mechanical laboratory, under the direction of Professor Perry, who at present has charge of the instruction in engineering and in mathematics. The apparatus in this laboratory is nearly all of a novel kind. Among other experiments are those on the energy of a rotating body, the resistance of wire to extension and torsion, and of beams loaded and supported in various ways, and of the vibration of the pendulum, etc. Some of the apparatus used in these experiments, portions of which have been made in the school itself, are now on view in the Central Institution. Adjoining this laboratory are two workshops—one fitted with benches and lathes for wood-work, and the other with vises and machine tools. These workshops are in charge of a practical mechanic, and the students are able to construct models and machines for their own use and for the use of the college. There is also an engine-room containing a boiler and steam engine, which are provided with appliances for measuring evaporation, steam temperatures, steam pressure, etc.



FINSBURY TECHNICAL COLLEGE. ONE OF THE LABORATORIES FOR FIRST YEAR'S ELECTRICAL ENGINEERING STUDENTS.

The British Association at Montreal.

Arrangements have been completed for the meeting of the British Association at Montreal, to commence on Wednesday, August 27th. President Cayley will be succeeded by Right Hon. Lord Rayleigh, president elect, who will take the chair and deliver an address.

Contributors of papers to the meeting are required (under an arrangement dating from 1871) to send to the "General Secretary of the British Association," 22 Albemarle street, London, W., an abstract of the paper, suitable for insertion in the transactions of the Association, together with the paper, with a statement as to the section for which it is intended, that the committee may decide, in advance of the time of the meeting, as to the acceptance and time of reading.

Among those who have signified their intention of visiting America this fall, are the following, who will, as physicists, be interested in the Electrical Exhibition.

Lord Rayleigh, Sir William Thomson, W. H. Preece, Sylvanus Thompson, Dr. E. Hopkinson, William G. Adams, J. Dewar, R. T. Glazebrook, O. Henrici, W. M. Hicks, John Couch Adams, George Forbes, Rev. S. J. Perry, Arthur Schuster.

Comparison of the Transmission of Force by Electricity as Compared with the Other Most Common Mechanical Transmissions.

BY A. BERINGER.

If we admit that the local conditions are equally favorable to the four systems (viz., electricity, water under pressure, compressed air and telo-dynamic cables)—that is to say, if we set on one side particular considerations which may render one or the other system more suitable in a given case, the comparison of prices shows that electricity and telo-dynamic cables are the most favorable agents for the transmission of power. Be

tween these two we must choose the cable as effecting the cheaper transmission up to a distance of one kilometer, but for greater distances electricity is preferable.

We note, in passing, the interesting result that a hydraulic motive power transmitted by electricity to a distance of 20 kilometers costs less than the same power produced on the spot by a large improved steam engine, even if we calculate the water power at 0.03 franc per horse-power hourly. It follows that a powerful water-fall will supply, within a radius of four leagues, power cheaper than that produced by steam engines of 100–200 horse-power, and within a far wider radius it will compete advantageously with small steam engines, or with gas.

Although cables are very suitable for distributing power in the country to a few separate places, they are quite out of the question when it is required to effect unlimited sub-divisions—*e. g.*, in a distribution of power from house to house in a town. In this case the three other systems remain alone in the field.

For distances of less than one kilometer electricity has only the advantage of a few centimes over air and water, but its advantage increases for longer distances. Thus the hourly cost per horse-power for ½ kilometer is 0.24 franc, for 1 kilometer 0.25 franc, and for 12 kilometers 0.37 franc, whilst water and air reach this price for 1½ to 2 kilometers.

Transmissions by water and air are, therefore, far surpassed by electric transmission, and, if we wish to produce power by steam in a central establishment and distribute it from house to house within a radius of 10 kilometers, electricity alone could furnish an economical solution of the problem.

We must here remark that such a distribution of power can only be, for the present, useful in the small trades, for if more than 10 horse-power is required a special motor is more advantageous.

If we divide the region to be supplied with power into squares of 8 to 10 kilometers a-side, having each a large steam motor, we may supply a horse-power at 0.25 franc hourly as against 0.32 franc, which would be the cost of a gas motor, which is a consider able economy in favor of electricity.

There are numerous cases where local conditions render it impossible to set up a motor at the place where the power is required, and only certain systems of transmission can here be employed. Thus, in mining and tunneling, air and electricity only are applicable, and, if we suppose that there is need for 10 horse-power, we see, on comparing the price of this power transmitted by compressed air and by electricity, that the advantage is greatly in favor of the latter. For more considerable transmissions of power the prices agree fairly well up to five kilometers, but beyond this the advantage of electricity becomes very decided. In addition, an electric transmission is more easily established than the conduction of compressed air, and it is much easier to extend a system of the first kind than of the second.

Certainly, boring machines with compressed air often suffice for ventilation, whilst an electric transmission of power requires to be accompanied by especial appliances for this purpose. Still the advantages of electricity, as regards convenience and economy, are so great that we cannot hesitate to employ it whenever there is no fear that sparks from the dynamo machines may occasion explosions, especially as electricity can at the same time serve for lighting.

In conclusion, in cases where telo-dynamic cables are not applicable, electric transmission is much preferable to transmission by water or compressed air. It is more economical than gas motors for transmissions up to five kilometers. Where transmission by cable is applicable, it is the more economical up to one kilometer. From one to five kilometers electricity has the advantage.—*Revue des Mines.*

Gas lamps to the number of 3,750 have been replaced by electric lights in this city. New Yorkers declare that they will have "more light."

Origin of the Earth's Magnetism.

The phenomena of magnetism for a long time after their discovery remained as facts that stood by themselves in science. Though it was for many years strongly suspected that some kind of relation existed between the phenomena of magnetism and those of electricity, yet the exact nature of this relation was by no means clear.

There was, indeed, but little hope of discovering the relation between magnetism and electricity as long as the principal source of electrical excitement was limited to the friction of one substance against another. When, however, Alexander Volta made his magnificent discovery of the voltaic pile, and showed how readily electricity could be produced by chemical action, the probability of the discovery of this relation was assured. Volta announced to the world his discovery of the battery in the year 1800, some four years after he had actually made it; and, although many scientific men endeavored to ascertain the relations between magnetism and electricity, yet it was not until the year 1820 that Hans Christian Oërsted, after long and patient study and experiment, discovered that when the poles of a voltaic battery were joined by a substance that would allow the passage of the electricity, this conductor acquired the power of attracting and repelling a magnetic needle in exactly the same manner that a magnet would do.

As might naturally be expected, this discovery produced great excitement in the scientific world. Immediately a number of scientific men in different parts of the world repeated and enlarged upon the experiments of Oërsted. Prominent among these may be mentioned the names of Arago, Ampere and Davy.

Briefly stated, Oërsted discovered that in order to produce a magnet from an electric current it was only necessary to pass a current through a conductor. It mattered not what the substance of the conducting body was; if it permitted the electric current to flow, it thereby became a magnet. Moreover, except in the case of such substances as hardened iron and steel, the conductor possessed magnetic properties only while the current was flowing through it. As soon as the current ceased, the magnetism ceased.

The above facts will, perhaps, be best understood by referring to an experiment first tried by Arago in 1824. If the poles of a comparatively powerful battery be closed by a short piece of copper wire, so as to permit the current to flow through it, iron filings thrown on the wire will be found to adhere to it in the same manner as if they were thrown on a magnet. On carefully examining the wire, the filings will be observed to have collected over its surface in sharply-marked lines that extend in right angles to its length. As soon as the current ceases to flow, the wire loses its power of attracting the filings, which, of course, at once fall from it. Since copper is not a magnetic substance and therefore loses its magnetism as soon as the current ceases to pass, the cause of its magnetism is clearly to be ascribed to the electrical current and not to any inherent property in the copper itself. Anything, therefore, that will conduct a current will necessarily be rendered magnetic by its passage. A very curious instance of this may be obtained by passing a sufficiently strong current through the human body, which will thereby acquire the power of attracting and repelling a magnetic needle.

In order the better to understand the magnetic effects produced by the passage of an electric current through a conductor, let us suppose that a wire through which a current of electricity is passing, is brought near a magnetic needle. We will observe that the needle will instantly move out of its position of rest, and come to rest in a new position. Suppose that when the wire was held under the needle, the latter was observed to move in a certain direction. If now an electric current be caused to flow through the wire in the opposite direction to that in which it was formerly flowing, we will notice that the magnetic needle will move in a direction opposite to that in which it previously moved. The electric current, therefore, causes polarity in a conductor; that is to say, the conductor has a North and a South pole, just as an ordinary magnetic needle has. A change, then, in the direction which the current flows through a conductor, produces a change in the direction in which this conductor will deflect a magnetic needle.

Suppose, now, that, without changing the direction in which the current is flowing through the conductor, we compare the effect of the conducting wire on the magnetic needle when held over the needle, with the effect it produces when held under it. We will find that the magnetic needle will be moved in the opposite direction. What, then, would be the effect of coiling a conducting wire in a loop around the needle? Since that part of the conductor that is above the needle, would then have the current flowing through it in an opposite direction to that part of the conductor which is under the needle, the effects of both of these parts of the conductor would clearly be to move the needle in the same direction. When, therefore, we wish to obtain powerful magnetic effects by the flow of the electrical currents through conductors, we wrap the conducting wire in the shape of a hollow coil or helix, and pass an electrical current through it completely from one end to the other. In order to force the electrical current to flow through the entire length of the conducting wire, and to prevent it from taking a short passage across the helix, it is necessary to wrap the wire with some non-conducting substance, such as cotton or silk thread. Wires wrapped with this substance are said to be insulated.

A very important fact in connection with the hollow coils or helices just described, was discovered in England in 1821, by a gentleman named Sturgeon, who found, that by wrapping a coil of wire around a core of soft iron, the magnetic effects of any given current were very greatly increased. A coil of wire wrapped around a core of soft iron constitutes what is now known as an electro-magnet. Soft iron is a substance that possesses the exceedingly valuable property of acquiring and losing its magnetism with great rapidity. In this respect it differs greatly from hardened iron or steel, which is difficult to magnetize, but, when once magnetized will retain this property for a very long while.

Bars of hardened iron or steel, when magnetized, are called permanent magnets, in order to distinguish them from temporary magnets produced by electric currents.

It is on account of the ease with which an electro-magnet acquires and loses its magnetism that it is of such great value in electrical apparatus. If an electro magnet is placed in an electric circuit, as soon as the current passes through its coils, it instantly acquires the property of attracting a mass of iron placed near its poles; while as soon as the current ceases to pass, it at once loses this property.

Many theories have been formed in order to account for the phenomena of the earth's magnetism. Of all these there is, perhaps, none that seems so probable as that which ascribes the earth's magnetism to the circulation of electric currents around the earth. We have already seen that the directive action of the earth on a magnetic needle can be best explained by supposing the earth to be a huge magnet, with its magnetic poles in the neighborhood of the earth's geographical poles. If we suppose the entire earth to be crossed by electric currents that flow from East to West, in a direction parallel to its magnetic equator, the entire earth will be rendered magnetic, with its poles in the position necessary in order to produce all the observed magnetic effects. It is not necessary to suppose that the electric currents cross the earth in exactly this direction, since currents flowing in other directions would produce similar effects.

Although it is not certainly known just how these electric currents are produced, yet it would seem to be more than probable that they can be ascribed to the sun's heat. It is well known that electricity can be produced by the unequal heating of different substances. It is quite possible, therefore, that differences of temperature of the earth's surface, caused by the apparent movement of the sun through the heavens from sunrise to sunset, may produce the electric currents to which we have referred. A circumstance that would appear to favor this general theory is the variations observed in the intensity of the earth's magnetism during the differences of temperature to which its surface is exposed during the different hours of the day, the different days of the year, or different cycles of time, and which we have already noticed under the different diurnal, annual and secular variations of the magnetic needle. It has been noticed, too, that the periods of unusual solar activity, such as are indicated by the appearance of spots on the surface of the sun, are invariably attended with great disturbances in the earth's magnetism.

The electro-magnetic theory we have just explained, is by no means beyond criticism, and many other theories have been advanced; for example, it has been held by some that the sun itself is a huge magnet, and that the earth acquires all its magnetic force from the sun by the mere fact of its nearness thereto, that is, by induction. Although this theory has some facts to recommend it, yet it is, nevertheless, by no means entirely free from objection.

Conversion of Liquid Batteries into Dry Batteries.

By MM. Bequerel and Onimus.

Several experimentalists, and, among others, Bagration, have sought to obtain batteries more or less dry. The latter, by mixing sand with hydrochlorate of ammonia, arrived at a result which is often put in practice. We have modified this result by mixing gypsum intimately with the exciting liquids, and then allowing it to set. The only batteries for which this process would be advantageous are evidently those which act only when the circuit is closed, and among those the hydrochlorate of ammonia (sal ammoniac) battery, and that with chloride of zinc, are the only ones which present any real advantage. Instead of employing gypsum alone, we mixed it with peroxide of manganese or sesquioxide of iron. Under these conditions the electromotive force is a little greater, and especially with sesquioxide of iron, the renewal of the electromotive force on opening the circuit is very energetic. When the battery is completely exhausted it is merely needful to make it imbibe a solution of the exciting salt to make it act anew. This procedure has the advantage of suppressing the exterior vessel and of giving the elements various forms according to circumstances. In fine, we believe we have succeeded in adding to the actions of ordinary batteries the advantages (considerable in certain cases, *e.g.*, medical apparatus, military telegraphy, etc.) of dry batteries, and that by a simple and inexpensive method.—*Comptes Rendus.*

The Southern planters are discussing the proposition to make the electric light an auxiliary in cotton raising. Experiments prove that this light causes great havoc among flying insects. They will fly straight to it over long distances, only to perish in its withering flame. The fruit raisers of Los Angeles are beginning to use it to attract and destroy the moths and flies that ravage their gardens and vineyards, and it is said they succeed in killing more insects in this way than by any other method. Travelers who go up the Upper Mississippi have observed that in the vicinity of Keokuk and Nauvoo the steamer's electric light at night will be surrounded by swarms of what are called "Mormon flies," which play around the dazzling flame till they are singed, and then drop dead upon the deck. The cotton planters propose to turn this hint to account for the destruction of the moth which produces the boll worm, a destructive enemy of the cotton plant. One electric light will serve for twenty acres, as the moths will fly to it as far as they can see it; and it is estimated that the cost of lights for a large plantation would be amply compensated in the increased yield of cotton

which the destruction of worms would result in. Electric lights in cotton fields would certainly show the application of science to agriculture in the South.

The Electric Motor.

THE HISTORY OF ELECTRIC AND MAGNETIC LOCOMOTION.

The following interesting sketch on this subject has just been given to the press by Mr. Bentley, and may be of considerable interest to some of our readers:

It is almost unnecessary to say that the electric motor was invented over fifty years ago and has been in extensive use ever since. The first inventor is a matter of some dispute, but the invention follows very naturally from the investigations in electro-magnetism made by Professor Henry about 1830.

Probably the first motor giving direct rotary motion was made by Sturgeon in 1832. A number of others soon followed, but the one attracting the most attention, and on which great hopes were based, was invented by Thos. Davenport, of Brandon, Vt., and was fully described in the *Am. Journal of Science and Arts* for April, 1837. Of his experiments it was said "one of the machines with a motive wheel only seven inches in diameter has been attached to a turning lathe, and moves it with astonishing strength compared with the small size of the propelling engine."

We also find the following financial appeal, which to the stock sellers of the present day must seem an example of untutored simplicity: "For the purpose of raising funds to carry on experiments, etc., a joint stock association has been formed in New York, of which Mr. Edwin Williams, No. 76 Cedar street, is agent. By this arrangement the principal interests of the patent for the United States and Europe being placed in a stock of three thousand shares, the proprietors offer an opportunity to public-spirited individuals to become associated with them in the enterprise, which it is hoped for the benefit of mankind may be successful."

Another electric motor attracting wide attention about that time was invented by Prosessor Charles G. Page, of Washington, D. C. An account of this motor and its application to locomotive purposes was given in a lecture delivered by the inventor in New York, and printed in the *Scientific American*, of November 15, 1851. At that early date electric motors were successfully applied to locomotion, both on land and water. In April, 1837, Sturgeon announced his having succeeded in propelling a boat, and also a locomotive carriage, by electro-magnetism—see "Sturgeon's Annals of Electricity," vol. i., p. 250. In the same periodical for October, 1840, are given a cut and description of the electric locomotive of Uriah Clark, of Leicester, England, which was run for two months on a circular track at the Leicester Exhibition of that year. Davenport, whose motor was mentioned above, ran a locomotive in 1842, on a railway near Glasgow. This locomotive which is described in the lecture by Professor Page, above cited, weighed five tons, and developed one horse power, attaining a speed of four miles an hour. In this country, about the same time, Professor Page obtained an appropriation from Congress to aid in experiments on this subject, and constructed a locomotive which traveled from Washington to Bladinsburg on the Baltimore and Ohio Railroad.

In electric locomotion by water, the most successful inventor was Professor Jacobi, who, in 1839, propelled a boat by electricity on the Neva.

The following very interesting letter, from Jacobi to Faraday, is found in the *Mechanics' Journal*, 1839, vol xxxii., p. 64:

"During the past autumn, and at a season already too far advanced, I made, as you perhaps have learned from the gazettes, the first experiments in navigation on the Neva, with a ten-oared shallop furnished with paddle-wheels, which were put into motion by an electro-magnetic engine. Although we journeyed during entire days, and usually with ten or twelve persons on board, I was not well satisfied with this first trial; for there were so many faults of construction and want of insulation in machines and batteries, which could not be repaired on the spot, that I was terribly annoyed. All these repairs and important changes being accomplished, the experiments will shortly be recommenced. If Heaven preserve my health, which is a little affected by continual labors, I hope that within a year from this time I shall have equipped an electro magnetic vessel of from forty to fifty horse-power."

In all the inventions I have described the source of electricity was a galvanic battery carried by the locomotive itself; but others used a stationary generator and conducted the electricity to the propelling motor by means of conductors laid along the track or by the rails themselves. Mr. Pinkers, an Englishman, invented, in 1840, an electric railway of this description; from his stationary source of supply the current was led to his moving locomotive by two copper conductors, which were fastened to a beam of insulating material laid between the rails; two sliding blocks of copper depended from the locomotive and rested in contact with the two conductors respectively, and from thence to the two blocks, the current passed to the propelling motor on the train. Mr. Pinkers' electric railway is fully described in his English patent, No. 8,644, of 1840. A railway of this kind is described in the *Mechanics' Magazine* for 1847, vol. 47, page 559. It was invented by Messrs. Lilly & Colton, of Pittsburgh, Pa. In the description it is said: "The power is applied not to the locomotive, but to the track, and herein consists the novelty of the invention or discovery. Two currents of electricity, positive and negative, are applied to the rails, and from thence communicate with the engine. The latter is provided with two magnets, which, by a process of attraction and repulsion, drive the car over the track. Heretofore the propelling power has been used on the car itself; in this instance, however, the power is in the rails, and an engineer may remain in one town and with his battery send a locomotive and train to any distance required." Of a later date is the railway of Bellet and De Rouvre, described in an English patent of 1864, No. 2,681, in which two wires are stretched beneath the car to convey the current to the locomotive; also, that of Hallez de Arros, of Nancy, France, in 1873, in which the inventor, in his patent, says, after describing his locomotive: "The battery or source of electrical power may be mounted on the carriage, as above described, or it might be fixed in position and the electrical current might be transmitted by conductors laid along the rails, or by the rails themselves."

There have been other electric railways invented, but the above historical sketch is sufficient to demonstrate the absurdity of the gentleman in question claiming to have invented the electric railway, or having the control of the art in his grasp. In the railway invented by Mr. W. H. Knight and myself, which has recently gone into practical operation in Cleveland, in connection with the Brush system, we make no extravagant claims to be the first persons to whom the idea of electric locomotion has come, but we do claim that we have taken up only devices which are free as air to every inventor, and by inventions of the utmost importance have rendered electric railways a practical success, while Mr. Field and other inventors have not got beyond the crude devices invented in 1840. E. M. BENTLEY.

Washington, D. C., August 4.

On the Electrical Resistance of the Human Body.

In my communication to *Nature*, I described the use of alternating currents and the telephone for the above purpose, and promised to endeavor to obtain at least an approximate measurement of the E.M.F. developed in the secondary coil of an induction apparatus. This promise I now propose to fulfill. But before proceeding to the special subject of the present note I should wish to draw attention to a paper which appeared on the 15th of the same month in the *Asclepiad*, by that able experimentalist, Dr. B. W. Richardson. He therein describes not only experiments made with the large induction coil of the Polytechnic, but also others made as early as 1868 in conjunction with the late Mr. Becker, the object of which was to obtain the measure of the resistance of animal structure.

"The results," says Dr. Richardson, "were not fully satisfactory. They were variable even when the conditions under which the experiments were made were entirely the same. This variability we found to be due to decomposition of the animal substance—a decomposition which, however feeble the battery, was sufficient to destroy the precision we desired to obtain." Putting the more recently coined word "polarization" for decomposition, this expresses exactly the difficulty described by me in my first note. "It was, however, possible," says the doctor, "to make out that blood conducted better than any other structure of the body, and better than water." I can now fully corroborate the excellent observation, and perhaps extend its application.

Physiological and even pathological fluids, such as the serum of dropsy, conduct far better than muscle, bone and nerve. One instance out of many may serve. In the very first case recorded in my communication to *Nature* (Vol. XXVIII., p. 151), the lowest resistance obtained from foot to foot was 2,300 ohms. The patient was then very emaciated, but quite free from dropsy. Towards the end of the case, which after death proved to be one of ulcerative endocarditis, as I had considered it to be during life, slight but distinct dropsical effusion in the lower extremities set in; the resistance sank at once to 700 ohms, and I had to discontinue my observations from the evident change of electrical conditions. I have since verified the same fact many times, and on it I partly found the belief, already several times stated, that "the human body, in spite of its large amount of liquid constituents, follows a similar thermal law of resistance to that influencing solid conductors, though in a very much higher ratio" (*Nature*, Vol. XXVIII., p. 152).

Dr. Richardson does not seem to have attempted the resistance of the living body, which Du Moncel, in 1877, did, and with fairly accurate, if unpleasant, results (*Nature*, Vol. XXIX., p. 528). On the discovery, however, in 1879, of Professor Hughes's electric balance, he resumed his observations, this time with an alternating induction current, though he does not himself notice the important change. His results are unfortunately taken in arbitrary units on the graduated scale of 200 parts originally applied to Professor Hughes's instrument. If there is any way of reducing these fictitious to absolute values, my work will be both lightened and assisted by a proved observer. Blood-clot and serum, white and gray nervous substance, muscle, bone, coagulated albumen, gelatine, and pus were all tested. Some of the results were excellent. For instance, fat, which by one experimenter has been stated to increase the conductivity of the body, is found by Dr. Richardson, as I also have found it, to be an absolute non-conductor. It is almost unnecessary to say that, with so skilled a chemist and physiologist, all proper temperature corrections and other similar precautions were most strictly observed.

I can now proceed to the main topic of my present note. On receipt of the Wurzburg dynamometer it was put in adjustment, and a strenuous effort made to compare the indications given with a constant and an alternating current, to both of which it is sensitive. But the movable suspended coil made of an ivory core, with a double weight of silk-covered copper wire, hung by a platinum hook, and dipping by its other termination into a vessel of strong sulphuric acid by means of a platinized platinum plate, is very heavy; takes a long time to get to its full deflection, thus allowing the battery to run down sensibly, and, what is worst of all, has a tendency to "integrate." By this I mean to sum up, by its mechanical inertia, a large number of small, intermittent pulls as given by the reversed current, into an almost identical deflection (less, of course, losses) with that given by the one steady pull of a continuous current. In spite of its beautiful workmanship, it had to be discarded for the present research. Somewhat in despair I fell back on a similar instrument, shown by me at the Oxford meeting of the Physical Society in June, 1882, and there heavily abused. The moving coil in this is made of silk-covered aluminium wire to insure lightness, and the bifilar suspension is made of the silver-gilt wire used for military epaulettes and facings. It is the work of my own poor hands.

Herr Obach then stated, and the statement was repeated in your columns, that this material had already been used by Messrs. Siemens for their "dust recorders," but had failed by difficulty of making contact. On testing my little toy, I found its resistance had not altered in twenty-five months one fraction of an ohm, and that it moved briskly up to its maximum, standing there quite long enough for a good observation. Indeed, in spite of its condemnation by a jury of experts over two years ago, it was still so lively that I thought it better to check extra swing by a small platinum paddle one cm. square, moving in sulphuric acid.

On a meter scale, at one meter distance, the reflected image in a telescope gave .365 mm. deflection* with the whole induction current from Professor Kohlrausch's meter-bridge, as described in my last note.

The object now was obviously to obtain an independent measure of the actual E.M.F. to which this deflection was due. The quadrant electrometer, or some other delicate potential measurer, of course, suggested itself. A trap-door portable, kindly lent me by Professor McLeod, refused to take notice of my wretched little currents, limited as they are by human susceptibility. I do not possess a quadrant, nor will the Royal Society, though twice asked, lend me one. Here again my friends at Cooper's Hill came to my rescue, and I have to express my thanks, not only to Professor McLeod, but also to Professor Stocker and his excellent demonstrator, Mr. Gregory, for their assistance. With my Kohlrausch induction bridge in a big bag I journeyed to Egham, and thence on foot to Cooper's Hill.

The formula to be made use of was obvious. It is given in Professor Adams' Cantor lectures, and has been kindly verified for me by Professor Hopkinson. In it the needle is connected with one pair of quadrants, so that $V_3 = V_4$. In this case—

$$\text{Deflection} = \frac{k}{2}(V_1 - V_2)^2.$$

Prof. Adams has since shown me a different, and perhaps better, way of working, which I intend to make use of in the future. It was found that the two fine quadrant electrometers at Cooper's Hill College were unavailable; the one given by Lord Salisbury not admitting of the needle being placed in connection with either pair of quadrants, the other being disabled by some casual contact. We therefore with heavy hearts made a last struggle with the old Elliott pattern and single quadrants. This succeeded admirably, and on a mean of the four best out of six observations, we obtained a deflection of 107 with the intermittent current. "In order to be quite sure," Mr. Gregory wrote to me next day, "of the true value of the mean deflection we obtained, I have executed measurements with different numbers of cells. In these, the negative pole was to earth, the positive being connected at will to either pair of quadrants, and the needle also at will to either pair, giving four readings for each observation. I give only means, which agree well.

E.M.F.	Defl.	k
21 volts.....	32.75.....	.149
29 "	63.75.....	.151
47 "	161.75.....	.146
Mean.....		.1486

k was calculated from the formula

$$\delta = \frac{k}{2}(V_1 - V_2)^2.$$

By calculation, using the mean value of k, the E. M. F. to give a deflection of 107 came out 38. By observation, using an E. M. F. of 38 volts, the deflection was 107.25. This agrees so well with the calculated value that it will be easy to evaluate the E. M. F. corresponding to any deflection by the above formula."

The effect of rapid alternations seems to be to lessen the deflection, though Mr. Glazebrook stated, in a paper read before the Physical Society, that with between 10 and 120 contacts per second the result, in charging a condenser, was not perceptible.

On the whole, therefore, though I agree with Mr. Gregory that we have not obtained a measure of the maximum E. M. F., but only an integration, disregarding sign, the approximation is, I hope, superior to any made before, and affords a good general basis for further work.—W. H. STONE, in *Nature*.

* The bridge arrangement being entirely disconnected.

Electrical Review.

Published Weekly at 23 Park Row,

P. O. BOX 3329.

GEO. WORTHINGTON, }
WM. A. HOVEY, } - - - - Editors.
THOMAS H. DELANO, - - - - Publisher.

SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance.

Great Britain and other foreign countries, $4.00, in advance. Postage free.

EDITORIAL ANNOUNCEMENT.

Address all communications and make all checks and P. O. orders payable to order of Delano and Company, Proprietors. P. O. Box 3329, New York.

We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

NEW YORK, AUGUST 16, 1884.

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If accounts which come to us are to be trusted, the New Orleans Exposition is to show the finest exhibit of electric lighting, both arc and incandescent, yet seen. It promises to be one of the most interesting features of the exhibition.

We hear some complaints against the restrictions put upon exhibitors by the rules adopted for the Government of the Electrical Exhibition in Philadelphia. It is impossible to make rules to suit everybody, and without rules no exhibition can be a success.

The number of "underground systems" continues to increase and multiply. The man that finds one which is practical, that can be made an electrical and commercial success, has got a big fortune. But anything short of actual practical demonstration will fail to fetch the dollars.

It will be seen by a circular published on another page that the Brush Company is by no means disposed to "give it up so;" that it has appealed from the decision of Judge Shipman in the case against the Weston Company recently tried; and that it has a whole broadside of cases in court against alleged infringers.

It was claimed by a certain vendor of clams many years ago, that they should be eaten freely, because they "enlarged the heart, and increased the understanding." But now comes the inventor and manufacturer of an electric sweat band for hats whose claim sets forth that it "stimulates the imagination, strengthens the memory, and greatly augments the working power of the brain." Verily, great is electricity.

A geological map of France, on a scale of 1 to 500,000, prepared by MM. G. Vasseur and L. Carez, will be completed in 48 sheets early next year. It is the first that has been executed since 1842. Some of the sheets have already been sent to press.

Thus far Mr. Edison's statement that the storage battery is but little more than an electrical toy, hardly seems to be verified, and by no means makes it certain that it is not to progress beyond its present stage. Some very able electricians, both here and in Europe, are working at it with full faith in its development into a practical, commercial success, and their opinions and beliefs are by no means to be lightly thrown aside. It is to be hoped that the Philadelphia Exhibition will do much to promote progress in this direction.

"What will happen," asks a correspondent, "when the Bell patents expire?" Give it up. A great many things are likely to happen long before that time comes, and the "look ahead" is altogether too long. To give a more serious answer, it may be said that when the Bell patents expire they will be affected just as any other patents would be affected by expiration, viz: they will simply cease to be patents, and what they cover will be public property. But there are a great many "Bell patents," and it is likely that there will be many more, and we judge it will be many a day before they all expire.

It is not definitely known what subjects will be discussed by the Electrical Conference to be held in Philadelphia during the exhibition, but the following topics have been suggested: The sources of electrical energy; the theoretical conditions necessary to the most efficient construction of the dynamo electric machine for the various purposes of practical work; the electrical transmission of energy; the systems of arc and incandescent lighting; the theory of the electric arc, storage batteries, electro-metallurgy; lighthouses for the coast; applications of electricity to military and mining engineering; lightning protection; induction in telephone lines, and the problem of long distance telephoning; the question of underground wires; atmospheric electricity; earth currents and terrestrial magnetism; photometry and standards for photometric measurements, the ratio of the electro-magnetic to the electro-static system of units and the electro-magnetic theory of light, and, finally, on account of the pressing necessity for accurate and uniform electrical measurements, it is probable that the question of establishing a National Bureau of Physical Standards will receive proper attention.

As will be seen by the report of the meeting of the directors of the American Electric and Illuminating Company, held in Boston on Tuesday, there was voted the regular semi-annual dividend of four per cent. on the preferred stock, and an extra semi-annual dividend of two per cent. on all the stock, common and preferred alike. It was further resolved that, as the earnings would warrant the payment of three per cent. extra dividend instead of the two per cent. voted, that one per cent. of the entire capital stock be placed in a reserve fund, and that, for the future, all profits over and above four per cent. semi-annually on the preferred, and two per cent. semi-annually on all stock be placed in said reserve fund, until it shall equal fifty per cent. of the entire capital stock. It is gratifying to see that this company, which, from insignificant beginnings, and against obstacles apparently insurmountable, has come to take a foremost place in electric lighting, is meeting with such excellent success, and it is peculiarly gratifying to see that it is disappointing the hopes and wishes of its enemies by adopting a policy so conservative as that outlined above. Three things have contributed to its success: good management, a good light, and slander; and the most effective has been slander.

AN EXPLANATORY WORD.

The following communication has reached us:

ATLANTA, Ga., July 24. 1884.

MESSRS. DELANO & CO.—I desire to know the value of Mexican telephone stock, either the parent company's or the Mexican local companies'; and, understanding that your MR. DELANO is connected with these companies, I venture to ask for the information.

Yours respectfully,

J. C. K.

Our correspondent has evidently confounded the proprietors of this paper with the old firm of Delano & Haines, who exploited the Mexican telephone business, and we take this opportunity to set him, and others who have this false impression, right.

Mr. Thomas H. Delano, one of the proprietors of this paper, and the only one bearing the name of Delano now or at any time in any way connected with it, has never been connected with any telephone or other electrical company before or since he became interested in the ELECTRICAL REVIEW, and is not to be confounded with Mr. F. M. Delano of Mexican telephone fame, and of the late firm of Delano & Haines. He has been prominently connected with important class journals in this city for some years past and has devoted his entire time to newspaper work and not to any kind or description of stock jobbing operations.

It may do no harm to add, in view of the misapprehension to which this similarity of names has given rise, that this paper is owned and controlled exclusively by Geo. Worthington and Thos. H. Delano, and that it has no interest to serve other than the general electrical interest, concerning which it is its aim to "give the news and tell the truth about it."

CONCERNING EXPERTS.

Patent cases, involving often very large and important interests, turn very largely, of course, upon expert testimony. This testimony, naturally, is of two sorts—testimony of fact and testimony of opinion. The value of an expert's testimony as to facts depends upon his knowledge of the subject, and upon his personal reputation for truth. The value of his testimony of opinion depends upon the quality of his judgment and his personal honesty. In speaking of the "value" of his testimony, it is not its money value, nor its value to one side or the other, but rather its value as a factor in getting at a determination of exact justice that is meant.

Now there are two kinds of experts, or, rather, there are two ideas of what an expert should be, and such demand finds its ideal supplied. There is what may be called the judicial expert, whose only aim is to tell what he knows, and all that he knows, in the interest of science, truth and justice, without evasion and without repression. On the other hand, there is what may be called the advocate expert, who, like a lawyer, freely admits that it is his desire and aim to win his case for the client by whom he is employed, and that to accomplish this it is his right and duty to make the most of every point in his favor, to take advantage of every technicality, and, so far as he can, to keep back and out of sight everything that makes against his client's interests.

It is true that of the first kind, or judicial experts, there are few, for the reason that the demand is light, and that of the second sort, or advocate experts, there are many, because the demand is great. It is not to be expected that litigants will employ expert witnesses without knowing what the nature of their testimony is to be, nor that the desire for exact justice rises so far above self-interest in their minds and wishes as to lead them to knowingly put upon the stand men whose evidence would make against them. It is the duty of the other side to do that, not because it has any superior love for exact justice, but because it has its own interests to protect and its own case to win, if possible.

This division of experts into two classes, judicial and advocate, renders it possible to understand how a man may be an honest and competent expert, and still have a point to make for the side that employs him. He sells his opinion for the benefit of his client, it is true—just as the judge sells his opinions to the State for a stipulated sum per annum—but he does not sell as his opinion what is not his opinion, although cases of that kind have doubtless occurred. A good and honest lawyer brings all the law to bear in favor of his client that he can find—it is no part of his duty to cite such law as makes against his client. So a good and perfectly honest expert, learned in science and the arts, brings to bear all that his learning teaches him in favor of the side which employs him. If the other side question him, he must answer on his oath and his conscience, but in his direct testimony he will, with the aid of counsel, bring out those points which most make for his own side.

The point has been raised, and it has even been proposed to incorporate it into law, that neither side should be allowed to employ experts, but that experts should be selected and employed by the court, and should sit in a semi-judicial capacity, as adjuncts and aids to the bench in determining questions touching which the judges could not reasonably be supposed to be well informed. The idea is a taking one, and its execution would seem to make for justice and economy. But the trouble is that experts, even the very best of them, are fallible, that in the realms of applied science no man may dare to say "I know," and that because of this fallibility there is danger of injustice through error. Justice is obtained in a court of law by allowing litigants to be represented by men learned in the law before judges who hear and determine from the sole standpoint of law. It is not evidence alone that determines causes. That might be got at without lawyers. It is the evidence seen through the law as expounded by advocates who are required to keep within the law, upon which the court, judging by rules of law, determines a cause.

Why might not similar procedure apply with advantage when the knowledge and opinions of experts are needed. Experts cannot by law, or in any other way, be kept off the witness stand. Each side has a right to bring forward such witnesses as it chooses, and the more intelligent and well-informed those witnesses, the better the chance of justice. Why not supplement these with an expert or experts who shall be appointed by the court, sit with the court, and lend aid to the court in making its decision, judging the evidence from the standpoint of science as the court judges it from the standpoint of law?

The New Orleans Exposition.

The arrangements for the "World's Industrial and Cotton Centennial Exposition" proceed apace, and the management is showing great enterprise and industry. From a circular just issued we quote the following:

INFORMATION FOR APPLICANTS FOR SPACE.

1. All articles intended for competition must be entered in the name of the manufacturer or producer.

2. Exhibitors will not be charged for space.

3. Exhibitors from the United States will be charged a uniform entry fee of $5 for each separate article entered for competition. The entry fee must accompany the formal application. Where collective exhibits are made without competition, the entrance fee shall be $5, except for State and Government exhibits.

4. No charge will be made to foreign exhibitors for entry fees.

5. It is understood that all articles are entered for competition, unless otherwise clearly specified at the time of entry.

6. Applicants for space, desiring to erect show cases, counters or partitions, must furnish to the Director General a drawing showing clearly the elevation and ground plan of the same, and especially indicating the sides of the cases intended to be open for inspection. (See diagram, second page.)

7. Applicants for space desiring to exhibit machinery will be required to furnish a drawing to a scale of ½ inch to the foot of the plan and distribution of the objects they

wish to exhibit, also the following information:

Actual horse-power required for each machine.

Cubic feet of steam used per hour, at a pressure of 70 lbs.

Diameter of steam, water, or gas pipes.

Diameter of discharge or drain pipes.

Diameter width of faces, and number of revolutions of driving pulleys.

The main shafts will make 120 and 240 revolutions per minute.

8. All countershafts, with their pulleys, belting, etc, for the transmission of power from the main shafts must be provided by exhibitors, and at their own cost.

9. A reasonable quantity of water, gas, and steam will be supplied gratuitously The quantity of each must be definitely settled at the time of the allotment of space, and must be clearly specified in the application.

Any power in excess of that allowed will be furnished by the management at a fixed price. Demands for such excess of power must also be settled at the time of the allotment of space.

10. Exhibitors of machinery requiring in excess of ten horse-power are at liberty to furnish their own engines, and steam at a pressure of 70 lbs. will be supplied thereto. This is entirely optional with the exhibitor.

11. When the allotment of space is definitely made, each exhibitor will be notified and furnished with a permit for space.

Permits for space are not transferable.

RULES FOR EXHIBITORS.

1. The Exposition will open on the first day of December, 1884, and will be closed not later than May 31st, 1885.

2. Articles will be admitted into the Exposition from the first day of August, 1884, to the first day of November, 1884, both days inclusive.

3. Articles must be in their places, and all arrangements completed by the 15th day of November, 1884. After this date any space not occupied, or partially occupied, will be at the disposition of the Director General.

4. The space granted to an exhibitor, within the building, is available floor or wall space, exclusive of the aisles and passage-ways between the exhibits.

5. The aisles and passage-ways are absolutely reserved for public convenience, under the control of the Director General, and no decorations, trophies, fountains, or any exhibits of any character whatsoever, will be allowed to project into, or be placed therein.

6. All arrangements of articles exhibited, and decorations, signs, etc., must be in conformity with the general plan prescribed by the Director General. No exhibitor will be permitted to display articles in such a manner as to obstruct the light or vistas through the aisles or passage-ways, or occasion inconvenience or injury to, or disadvantageously affect the display of other exhibitors.

7. Signs will not be allowed to project beyond the floor area of the space allotted. Signs made of paper, of muslin, of canvas, or of other light and combustible substances, will not be permitted. The size of all signs, character and position of same, is subject to the approval of the Director General.

8. Exhibitors' business cards, pamphlets, circulars, samples, etc., may be placed within and be distributed from within the space allotted to them.

9. Exhibitors will not be permitted to offer articles for sale in any other than the space allotted to them.

Hawking will not be permitted within the grounds or buildings.

10. The transportation, receiving, unpacking, and arrangement of articles for exhibition will be at the expense of the exhibitor.

11. Exhibitors will be permitted to designate agents to unpack, have charge of, and watch and repack their exhibits, at their own expense, the authority to such agents to be filed with the Director General.

12. The management will take precautions for the safe preservation of all objects in the Exposition, but will in no manner, whatsoever, be responsible for loss or damage of any kind, or for accidents by fire or otherwise, however originating. Insurance is entirely at the option of exhibitors, and at their own expense.

13. Exhibitors must provide at their own cost, all show cases, shelvings, counters, fittings, etc., which they may require.

14. Special constructions of any kind, whether in the buildings or grounds, can only be made upon the written authority of the Director General.

15. No partitions of a greater height than two feet ten inches from the floor will be allowed, except on the side spaces next the walls of the building, where the partitions may extend to the gallery floor. Partitions in the galleries may extend to the roof girders. Counters and railings shall be of uniform height of two feet ten inches from the floor, on the sides next the passage-ways or aisles.

All platforms must be constructed at a uniform height of ten inches above the floor.

16. The general regulations promulgated August 15th, 1883, are hereby made part of these rules.

17. The right to alter or amend these rules is reserved.

The United States Electrical Commission.

In accordance with the provisions of an act of Congress passed at the last session, the following official document, constituting the United States Electrical Commission, and defining its duties, has been issued, and a copy sent to each of the appointees, viz:

DEPARTMENT OF STATE,
WASHINGTON, August 1, 1884.

.....

SIR: The President of the United States in pursuance of a special provision of Congress, has appointed a Scientific Commission which may, in the name of the United States Government, conduct a National Conference of Electricians in Philadelphia in the Autumn of 1884.

The following-named gentlemen have been designated as members of the Commission:

Prof. H. A. Rowland, Prof. M. B. Snyder, Prof. J. Willard Gibbs, Prof. John Trowbridge, Prof. C. A. Young, Prof. G. F. Brackett, Dr. William H. Wahl, Prof. Simon Newcomb, Prof. G. F. Barker, Prof. E. J. Houston, Prof. R. A. Fisk, Prof. Francis C. Van Dyck.

This Commission, of which it has been deemed advisable to designate Prof. Rowland as chairman, will have the direction of the scope and character of the Conference.

The law creating the Commission is as follows:

"That the President of the United States be and he is hereby authorized to appoint a Scientific Commission, which may, in the name of the United States Government, conduct a National Conference of Electricians in Philadelphia in the Autumn of 1884."

"That the sum of $7,500 be appropriated to meet the expenses of the Commission in conducting the Conference and investigations, and to meet the expenses of preparing reports of the same; *Provided*, that the whole amount of the expense incurred by said Commission shall not exceed the said sum of $7,500, and the members of said Commission shall not receive any compensation for services."

The Commission will, therefore, invite scientific men, native and foreign, to participate in the Conference, and will in general conduct the Conference in such manner as may seem most desirable to meet the ends in view.

The necessity of selecting the conferees, which is left exclusively to the Commission, requires that the first meeting of the Commission be held as early as August 7th, 1884, at Philadelphia.

It is hardly necessary to observe that this Commission, appointed for high scientific purposes, will not permit its influence to be exerted in behalf of any person or company, manufacturers of electrical apparatus or machines.

Your attention is especially directed to the fact that the members of the Commission do not receive any compensation for their services, and the whole amount of the expense to be incurred by said Commission shall not exceed the sum of $7,500, and that sum is to be expended according to the provisions of the law hereinbefore recited.

All expenditures should be under the immediate care and charge of the Commission, and proper vouchers rendered therefor.

Copies of this instruction have been mailed to each Commissioner.

I am, sir, your obedient servant,

FRANK T. FRELINGHUYSEN.

The first meeting of the Commission was held in Philadelphia, on Thursday, August 7th, at the Hall of the Franklin Institute. There were present Professors Rowland (chairman), Snyder, Gibbs, Trowbridge, Young, Newcomb, Barker, Houston, Van Dyck, and Dr. Wahl. An organization was effected by the election of Prof. M. B. Snyder recording secretary, and Prof. George F. Barker corresponding secretary, and the appointment of the Chairman, with the two Secretaries, Prof. Newcomb and Dr. Wahl as an Executive Committee. It is understood that the Commission discussed at length the subject of the proposed Conference, the manner in which it should be conducted, the scope and character of its work, and kindred subjects

A large list of subjects of theoretical and practical interest were submitted by the members as proper themes for discussion in the Conference, and of these, a number of the most important were decided upon. It was further decided to extend invitations to a number of native and foreign physicists of eminence, and practical electricians, to participate in the Conference.

The Commission then adjourned, to meet again during the present week. Until the Commission has fully decided upon the details of the week, no public announcement of its proceedings will be made. At the proper time the programme of the Conference, and the list of conferees who have been selected to participate therein, will be made public.

The time of opening the Conference was fixed for Monday, September 8th, in the large Lecture Hall of the International Electrical Exhibition.

American Electric and Illuminating Company.

At the regular monthly meeting of the directors of the American Electric Illuminating Company, held in Boston on Tuesday August 12th, 1884, the following resolutions were unanimously adopted:

Whereas, The earnings of the company for the past six months fully warrant the declaring of the regular semi-annual dividend of 4 per cent. on the preferred stock and an extra semi-annual dividend of 3 per cent. on the preferred and common stock; and

Whereas, The greatly extended business of the company in covering its newly acquired territory—necessitating the continued use of more capital—makes it expedient, and prudent to give due consideration to conservative business methods, and to make judicious provision for future contingencies in a substantial reserve fund; therefore be it

Resolved, That the following dividends be declared and made payable at the company's office, 197 Congress street, on Monday Sept. 1st, 1884, viz.: four per cent. on the preferred stock, two per cent. extra on the preferred stock, and two per cent. extra on the common stock.

Resolved, That an amount equal to one per cent. on the entire capital stock be taken from the accrued profits, and carried to a reserve fund.

Resolved, That until the reserve fund now created reaches an amount equal to fifty per cent. of the cash capital of the company, dividends shall not be paid in excess of the amount this day declared.

Resolved, That the transfer books be closed from August 20th to September 1st, 1884, both days inclusive.

Editors Electrical Review:

SIRS:—It was remarked in conversation a few days since that a great objection to the Thomson Graded Galvanometer is that, being calibrated in Glasgow, it is correct there and there only, and that when used elsewhere the lines on the base must be moved either forward or backward according to the locality in which the instrument is being used. That this view is rather common, I have since discovered, but that it is untenable may be easily shown. Though it has been several times described, it will be necessary, in order to be understood, to give a hasty description of the instrument. For simplicity I shall refer only to the Potential Galvanometer, the current instrument being the same in principle. The Potential Galvanometer consists essentially of a coil of insulated wire, of high resistance, fixed to one end of a platform on which rests a magnetometer. The latter is supported on three feet and a spring; two of these feet slide in a V groove, cut in a slip of hard wood let into the top of the platform, and this allows the magnetometer to be moved nearer to and farther from the coil, but prevents it from being so turned around as to change the zero reading of the instrument. The sensibility of the instrument is charged by changing the position of the magnetometer on the platform. When the front of the magnetometer is placed at any division of the scale marked on the platform, the number stamped at that division indicates the deflection in division of the magnetometer scale, produced by one volt difference of potential between the ends of the coil; the intensity of the magnetic field in which the needles are placed being supposed unity. A permanent magnet of semi-circular shape is supplied with each instrument for the purpose of producing a field at the needle much more intense than that of the earth. The total intensity of field is obtained by adding the horizontal component of the intensity of the earth's field to the number marked on the magnet. Such, in brief, is a description of the instrument.

In order to obtain the value of any deflection, the number of divisions in the deflection is multiplied by the number on the magnet plus the horizontal component of the earth's intensity at the place of test, and divided by the number at the division of the scale on the platform exactly under the front of the magnetometer. The result is the difference of potential in volts. Now, it will be seen that, were the objection, mentioned in the first part of this letter, to hold, it would be quite serious. For, if the figure at which the magnetometer rests, and which we are to use as a division, does not represent in New York what it did in Glasgow; or if it is not in its proper place we are all at sea. But the objection does not hold, for, as was stated in describing the instrument, the figures on the platform scale represent "the deflections in divisions of the magnetometer scale produced by one volt potential difference at the terminals: *the intensity of the magnetic field being supposed unity.*" These figures, then, are not determined for the magnetic field of Glasgow, London, or any other place, except, indeed, it be some place whose magnetic intensity is unity. The point is so plain that it is curious that any mistake should be made. It is true there are variables which, in using the instrument, should be taken into account. These are, change in intensity of the curved magnet, due to time and proximity to other magnets; and difference in intensity of the field due to the earth, according to locality. These intensities should be redetermined from time to time, but there is no reason whatever for altering the position of figures on the platform scale. JAS. F. KELLY.

Since writing the above, I have had an interview with the party whose remark is mentioned in the first part of this letter. He explains now that, in his case, there has been a partial misunderstanding. He admits now that, ordinarily, the scale on the platform need not be altered, but that, when he uses his instrument, the intensity of his field is not that due to the earth's magnetism, but is due to local causes, such as the proximity of dynamos, etc. As he has no means of determining the intensity of this field, he corrects by moving the figures on the scale. Of course, the true way would be to leave those undisturbed, and determine the intensity of field at place of test. J. F. K.

Telephonic News

*** The gross earnings for the week ending July 12 of the Mexican Telegraph Company were $3,518; of the Central and South American Telegraph Company, $3,965.

*** In India telephone work is going on steadily, and the number of subscribers at each of the centers is on the steady increase. In Calcutta, Bombay and Madras, the police and fire stations have had systems put in for them, which work to every one's satisfaction.

*** Our correspondent in the City of Mexico says that the Mexican Telephone Company, under the management of M. L. Guerand, is increasing its revenues rapidly, remitting nearly $1,500 monthly to the Boston office. Mr. Guerand has just closed a contract with the manager of the abattoirs here to connect the same with all butcher shops in this city by telephone. Sixty other new subscribers have been gained during the past month. It is proposed to establish other telephone exchanges in the various large cities in Mexico.

*** At the recent annual meeting of the Tropical Telephone Company, Col. Henry O. Russell, Charles Williams, Jr., Charles W. Jones, Nathan Appleton and Jas. H. Howard were re-elected directors. Owing to the small attendance of shareholders, the financial report was not read, but was referred to the directors, who will receive the same at their next meeting, after which an abstract will be printed. The company's sales last year were about 3,000 sets of telephones. Since July 1 orders for over 400 sets have been received. The profits on sales last year (July 1, 1883, to July 1, 1884) were about $18,000.

*** The second complimentary moonlight excursion, given by the New York and New Jersey Telephone Company to its managers and operators, took place August 5, and proved a most enjoyable affair under the management of Messrs. Barney, Reilly, and Perry, the Committee of Arrangements. The steamer Magenta carried from Jersey City and Brooklyn about 7:30 P. M. the officers, exchange managers, operators, and invited guests to the number of 300, and sailed up the East and Hudson Rivers and down the bay, returning in time for the midnight trains. General Floor Manager Noonan was ably seconded by Messrs. McCully, Lindsley, Quinn, and Crawford. The hours passed merrily, the dancing, music, and refreshments being enjoyed by all. Previous to the collation being served, addresses were made by the President, C. F. Cutler; Joel C. Clark, Treasurer; W. D. Sargent, General Manager; Superintendents Barney and Reilly, and Auditor Perry. Among the invited guests was Major Franklin Allen, representing Mayor Low of Brooklyn; W. N. Estabrook, General Manager New York and Pennsylvania Telephone Company; and H. L. Stork, General Manager Hudson River Telephone Company, all of whom indulged in humorous and complimentary remarks suitable to the occasion. Various letters and telegrams of regret were received from other distinguished gentlemen intimately connected with the telephone and telegraph interests of the country.

*** An English contemporary says: "When some six years ago the capabilities of the telephone began to be understood, it was thought for many purposes it would supplant the telegraph, and would be of special utility, for instance, in transmitting the debates from the House of Commons to the printing offices of the principal newspapers throughout the country. As a matter of fact, it is used for that purpose to a limited extent in London; but the results are not altogether satisfactory, and those who now use the telephone would, we suspect, prefer to employ a telegraph system which left them a record of what was received, even if it did not quite equal in speed the transmitting powers of the telephone. The telegraph is popularly supposed to be wonderfully quick in its action, as it is in one sense; but its signals have to be spelled out letter by letter, whereas what is wanted is a system that can transmit words with the minimum number of signals. Some few years ago Signor Michela, of Ivree, in Italy, devised a stenographic machine by means of which reports of debates could be written down in any European language with the same speed as the speakers uttered the words. For two years and more his machine has been in use in the Italian Senate, and has given every satisfaction. Lately the system has been developed into what is known as steno-telegraphy, in which the instrument, with its twenty keys, is made to transmit its stenographic signals to any number of receiving stations at the rate, if desired, of ten thousand words an hour. It is just as easy to translate these signals as to read the dots and dashes of the Wheatstone recorder; and before long steno-telegraphy will be as common as ordinary shorthand. An experimental installation of the system has been put up at No. 1 Rue Rossini, Paris, and it is not unlikely to introduce a revolution in telegraphy, which is really very slow, for the simple reason that on an average at least two signals have to be made to indicate one letter."

National Telephone Exchange Association.

SECRETARY'S OFFICE,
PULLMAN BUILDING,
CHICAGO, ILL., Aug. 5th, 1884.

DEAR SIR: On the 2d of July, by order of the Executive Committee, the undersigned sent you notice of a proposed adjournment of the September meeting of the association from Providence to Philadelphia. The proposition was that the association meet at Philadelphia upon Wednesday, September 3d. The undersigned has received numerous responses from the members of the association almost unanimously favoring the proposed adjournment, and accordingly the Executive Committee have made the necessary arrangements therefor.

The president has appointed the following local committee of arangements: Dr. S. M. Plush, general manager of the Bell Telephone Company, of Philadelphia; W. D. Sargent, of Brooklyn, and T. B. Doolittle, of New York. This local committee report that it is advisable that the association adjourn to meet at Philadelphia on Tuesday, the 16th day of September, two weeks later than the date originally suggested by the Executive Committee.

The reasons for the later date are as follows: First—Hotel accommodations of a suitable character can be procured to better advantage in the middle of September than near the beginning of the month. Second—The Electrical Exposition, which is the immediate occasion of the proposed adjournment, opens on the 2d of September, and will not be in complete order under two weeks from the date of opening. It is believed, further, that the middle of the month will better suit the convenience of the members in arranging to leave their own business.

The undersigned would, therefore, respectfully announce that the meeting will convene at Providence on Tuesday, September 2d, 1884, at the office of the Providence Telephone Company; and, if it be the pleasure of those present to adopt the suggestion of the Executive and Local committees, it will adjourn to meet at Philadelphia on Tuesday, the 16th day of September, 1884, at 11 o'clock A. M. Application for hotel accommodations, space for exhibits, and the like, should be addressed to Dr. S. M. Plush, care of the Bell Telephone Company, of Philadelphia. As soon as the place of meeting is selected, members will be notified direct by the local committee of arrangements, and full information will be given.

Very respectfully,
C. N. FAY, Secretary.

The United Telephone Company.

As we have at various times pointed out, much attention has lately been drawn to the position of the telephone industry in this country, and an agitation has set in throughout the business community which has found expression in the House of Commons, and bids fair to obtain from the Postmaster-General such facilities as will permit the further development of the telephone, and bring its benefits within the reach of the public at large. It is difficult to realize what this means unless one is acquainted with the progress made in other countries, notably the United States, where this modern giant has made enormous strides, for the actual number of exchange subscribers in this country, about 12,000, is no indication of the importance which the telephone must sooner or later assume amongst us. A very comprehensive series of tables, compiled by Gen. Thomas Sherwin, Auditor of the American Bell Telephone Company, throws a strong light on the development of the telephone in the States. According to this compilation, the following is the progress made during the year 1883, scheduled according to the population of the cities and towns:

Population.	Tel. Ex. Subscribers Jan. 1, 1883.	Jan. 1, 1884.
Over 150,000.....	21,361	27,997
50,000 to 150,000 .	16,512	17,335
10,000 to 50,000...	35,824	47,207
Under 10,000.....	24,031	31,000
	97,728	123,625

The net gain during the year has, therefore, been over 25 per cent., and as, according to the latest accounts, this rate of progress was maintained, we may take it that there are at present about 150,000 telephone subscribers in the United States. How utterly disproportionate the present position of the telephone is in this country is brought into full relief by these figures. It is evident that, given reasonable facilities on the part of the post-office, a number of subscribers in the United Kingdom of, say, 200,000, would not be an unfair estimate of what in a few years ought to represent the telephone interest. To the United Telephone Company, and its subsidiary companies, the task will evidently fall of doing this gigantic work. This company has quite recently absorbed—or is likely to absorb—its only rival, the London and Globe Company, and it has thereby obtained a complete monopoly of the telephone business in the United Kingdom, and rendered the Edison-Gower-Bell patents unassailable. The report issued by the directors at the meeting of shareholders held last week, furnishes evidence of the prosperous position already achieved by the company, notwithstanding the restrictive action of the post-office. The revenue of the company has risen from £64,826 1s. 8d., during the year 1882-83, to £92,344 15s. 9d., for the year ending April 30, 1884. The working expenses have not increased in the same proportion, being £31,590 7s. 3d., against £26,434 7s. 10d., for the preceding year, and with the growth of the exchanges the proportion will become more and more favorable. A further dividend of 5s. 6d. per fully-paid £5 share is declared, making the total dividend for the year 8 per cent., and leaving a credit balance of £15,061 3s. 7d., of which £10,000 are carried to reserve. The number of the subscribers to the company's London exchange has risen from 914 on April 30, 1881, to 3,350, on April 30 last; that of the private lines from 186 to 715. This progress reflects every credit on the directors, who have been able to achieve so much under difficult circumstances, but it is evident that the figure of London telephone subscribers, at the American rate, ought to be near 20,000. In the interest of the public, and especially of the large business community in this country, it is to be hoped that the Postmaster-General will now abandon his restrictive policy. In accordance with his suggestion, the views of the companies have been laid before him in the fullest detail, and we echo the wish of the board, "That the distinguished economist and statesman, who now presides over the department entrusted with a charge so vital to the interests of society at large as a monopoly of the transmission of letters, telegrams, and telephonic messages, will not allow any narrow views or stereotyped objections to stand in the way of the public good."—*London Postal Gazette.*

The National Telephone Company's Exchange at Edinburgh.

Attention has been called to the considerable progress made by the National Telephone Company, notwithstanding the difficulties under which it necessarily labors in consequence of the restrictions put on the telephone by the English Post Office authorities. This company—which was established in March, 1881—had, on December 31, 1882, 1,884 subscribers and 466 private subscribers, the number of exchanges being 24. On November 30, 1883, the number of exchange subscribers had increased to 2,896, and of private subscribers to 591. The continued active development of the company is shown by a further increase in the number of subscribers during the present year, the figures standing for June 30 at 3,561 for exchange subscribers, and 674 private subscribers. The revenue has increased from £34,117 14s. 5d. on December 31, 1882, to £49,027 on November 30, 1883, and to £57,270 on June 30, 1884. The third exchange of the company in number of subscribers is that at Edinburgh. It is less than four years since the first telephone wire was erected in that city, and for a considerable period its successors were few and far between. As the merits of the new instrument, however, as a means of rapid and confidential intercourse between widely separated points, came to be better understood, business men began to take advantage of it more and more, until to-day the subscribers to the central exchange system, which includes Edinburgh, Leith, Newhaven, Trinity, and Granton, number no less than 290. Amongst these are included nearly all the leading firms and institutions in the district. These 290 subscribers make amongst themselves, on an average, 1,480 communications per day. Every subscriber therefore employs his telephone, say, five times a day, or 1,825 times during the year. As each communication consists of at least one question and answer, this represents 3,650 messages or telelogues—as telephonic dispatches have come to be called—per subscriber per year. The rate of subscription being £15 per annum, the cost of each message is rather more than nine-tenths of a penny. As a matter of fact, however, seeing that the number of words of which a communication may consist is unlimited, it is scarcely fair to compare a telelogue with a telegram. The cost of the former is constant, whatever its length; that of the latter increases at the rate of 3d. for every five words over twenty. In addition it must not be overlooked that two telegrams are required to do the work of the shortest telephonic communication. Looked at from another point of view, the telephone costs each subscriber rather more than 9¾d. per day, or 5s. 9d. per week. The wages of this novel servant are therefore not in excess of that of an ordinary message boy. The company, moreover, supplies a second line to any subscriber at a cost of £10 per annum, thus materially reducing the expense of telephonic communications where, for instance, a place of business and a residence are both put in connection with the exchange.

The utility of the telephone in Edinburgh has lately been greatly increased by the opening of a trunk line to Glasgow, by means of which any subscriber to the Edinburgh exchange may be connected with any of the subscribers—and they number about 700—to the Glasgow exchange. The additional charge for this service varies from £50 to £25 per annum, according to the facilities required. The whole of this rental, owing to the conditions imposed by the Post Office, is paid over to the Government, the telephone company working the service free of charge for the benefit of its subscribers. It is to be hoped that in the negotiations now being carried on between the Postmaster-General and the telephone companies further concessions will be made to the latter as regards trunk wires. There are in all sixteen subscribers to this Glasgow line—three in Edin-

burgh, five in Leith, and eight in Glasgow—and if the departmental regulations were relaxed the number would, no doubt, be largely increased. As trunk wires also exist from Glasgow to Paisley and Greenock, Edinburgh subscribers may likewise communicate with the subscribers to the Paisley and Greenock exchanges upon paying the Government charges. It is an interesting fact that the trunk wire between Edinburgh and Glasgow is the longest telephonic line in the United Kingdom. The communications passing over it sometimes number fifty in one day.

Telegraph and Telephone Wire of the Most Superior Quality.

Our contemporary, the *Commercial World*, says the rapid extention of telegraphic and telephonic communication throughout the country has given a great impulse to the introduction of improvements in the manufacture of wire for such purposes, and it may almost be said that the acme of perfection in this line of goods has been reached. At least it is certain that the wire makers keep pace with the requirements of the electricians, and that any indicated need on the part of the latter is promptly met by the enterprise and mechanical skill of the wire manufacturers.

No concern has gained a higher reputation in the production of this class of goods than the Palmer Wire Company, of Palmer, Mass. They are extensive manufacturers of all descriptions of iron, Bessemer, and cast steel wire, bestowing especial attention upon the production of wire for telegraph and telephone work. Their mill is fully equipped with the latest improved machinery and mechanical appliances for the manufacture of goods of this class, and they can with confidence claim that their wire has no superior in the market. Only the best materials are employed in its production, and the minutest details of the manufacturing process are observed with the most scrupulous care. The quality of their goods is fully guaranteed, and the prices are the lowest that can be consistently named in connection with first-class material and workmanship.

Their wire is exclusively used by some of the largest telephone companies in the country, and very extensively by many others, and in all instances it affords the most entire satisfaction, as is evidenced by the numerous testimonials on file in the company's office. At the present, when line construction is being rapidly carried forward, the company is overwhelmed with orders, and the capacity of their works is tested to the utmost. Their "continuous process" enables them to furnish wire in great lengths, and in quality of material, finish, and conductivity, it is warranted fully equal to the best that is made. The company's works are very extensive and complete.

The estimation in which their wire is held is shown by the fact that the Palmer Wire Company were awarded the contract for furnishing the wire to be used in making the cable and hawser ropes for the U. S. steel steamers Chicago, Boston, Atlanta, and Dolphin, the building of which was some time since authorized by Congress. The quantity of the wire to be supplied is about 55,000 pounds, and the government tests imposed were of the severest description.

Steamer William Orton, of the Western Union Telegraph Company's cable service, successfully laid a new telegraph cable between Martha's Vineyard and the mainland on Sunday last. Communication was established Monday.

The Telephone at Plymouth, England.

The *Western Morning News* has the following on this subject:

"We do not think the Government sufficiently estimates the damage which is being done to its reputation by the action of the postal authorities with regard to the telephone. Interests which touch men's pockets and daily convenience are much more potent in influencing their politics than abstract views as to franchise or foreign policy. When it is seen that year after year the Post-office is acting as a deadweight on the development of the telephone, is repressing its extention to the purposes of commercial life and discourging inventors, it is obvious that such procedure becomes vastly irritating to business men, and leads them to desire a truly liberal administration of the department which has so long been guided by the worst instincts of ultra-Toryism. Much was hoped from placing so able and enlightened a statesman as Mr Fawcett at the head of the Post-office, and proportionately great is the disappointment at finding that in the matter of the telephone and telephone exchanges there is nothing but procrastination, repression, and narrowness, resulting in financial failure, and public inconvenience. In Plymouth, Devonport, and Stonehouse, three years ago, there were 150 residents, each of whom could speak to the other through a telephone exchange. But official pique on the part of the Post-office put a stop to this, and established a so-called Post-office exchange. The number of members has never exceeded forty-six; it has now fallen back to forty-two, and several other subscribers have given notice to leave unless the numbers are so increased as to make the exchange really worthy the name Plymouth is but a sample of nearly every other town where the Post-office monopoly has taken effect, and Post-office exchanges have been instituted. But for the Postmaster-General's veto a real and useful exchange might be established in the Three Towns next week, at a subscription for less than that which the Post-office demands. The Liberal Government protest against obstruction in Parliament, but itself practices it all over the country."

The River Plate Telephone Company.

It having been suggested by the committee of investigation of the Consolidated Telephone Construction and Maintenance Company, that the shareholders should individually purchase from their company shares held by it in the River Plate Telephone and Electric Light Company, it may be well to acquaint them with certain facts relative to telephone interests in the River Plate, in regard to which it is probable the gentlemen recommending them to make the investment referred to are themselves not thoroughly informed, but which have an important bearing upon the value of the suggested investment. The properties of the River Plate Telephone and Electric Light Company are situate in the cities of Buenos Ayres and Monte Video. In each of these cities there exists an opposition company, with more subscribers than the River Plate Telephone and Electric Light Company. The instrument in use by these opposition companies—the United Telephone Company of the River Plate in Buenos Ayres, and the Campania Telefonica La Uruguay in Monte Video—(and for which these companies possess exclusive rights) is that known as the "Bell-Blake," the only one used to any extent by telephone exchanges in England and the United States, and generally throughout the world. The instrument used by the River Plate Telephone and Electric Light Company, and the only one which that company has the privilege of using, is known as the "Gower Bell," and is universally acknowledged to be an inferior and almost obsolete instrument.

In the city of Buenos Ayres, the River Plate Telephone and Electric Light Company had, about one year ago, more than double the number of subscribers of the opposition company there. It now has less subscribers than that company. On February 1 of the present year there was no opposition to the River Plate Telephone and Electric Light Company in Monte Video. The opposing company in that city has already a larger number of subscribers than the River Plate Telephone and Electric Light Company. The rapid growth of these opposition companies is chiefly due to the superiority of the instruments used. It is but reasonable to anticipate that this superiority will continue to make itself manifest.

The United Telephone Company of the River Plate represents the interests of the most powerful telephone organizations of the United States, where the telephone has been made a far greater scientific and financial success than in any other part of the world. It is also allied to various local companies in the River Plate, having exchanges in Rosario, Santa Fe, Cordoba, and Parana, as well as at Monte Video. It can hardly be supposed that the gentlemen constituting the committee who recommend the purchase of these River Plate Company's shares, in the brief period they have been able to devote to their investigations, have become fully conversant with the situation of telephone affairs generally in the River Plate. A more extended and thorough investigation than they have yet had time to make would not, it is believed, have afforded proper grounds for such a recommendation.

.... The important pooling arrangement between the Baltimore and Ohio, the Postal and the Bankers and Merchants' Telegraph companies went into effect several days ago. These three companies will be conducted under joint management, with the following named officers: Executive manager, David M. Bates; general manager, Garrett S. Mott; general superintendent of the Eastern Division, James G. Smith; general superintendent of the Western Division, John E. Zeublin. The Eastern Division embraces the territory east of Ohio, including the old Southern Company's lines, and the Western Division embraces all of the territory west of and including Ohio. The respective headquarters of the two divisions are in New York and Chicago.

.... The New York, Ontario and Western Railway Company commenced an action in the Supreme Court last week to restrain the Western Union Telegraph Company from interfering with the wires along the line of its road. An injunction was obtained from Judge Bartlett restraining the Western Union from any interference until further order of the court. In 1878 the receivers of the Oswego Midland Railroad Company made an agreement with the Western Union by which the wires along its lines were to be operated by the telegraph company. The number of wires then in possession of the receivers and specified in the agreement was three. Subsequently the Ontario and Western Company purchased all the property of the Midland Company under foreclosure, the agreement with the Western Union being continued. This agreement terminated yesterday. About a week ago the Ontario and Western Company leased the wires in question to the Baltimore and Ohio Telegraph Company, to take effect upon the termination of the Western Union contract. After this contract was executed the Western Union Telegraph Company claimed to be the owner of one of the wires, and demanded that the railway company should either allow it the use of the wire or pay a large sum of money, and threatened that if its terms were not conceded to tear down the wire at once. Its claim is based upon the fact that the wire in question was put up previous to 1878 by the Atlantic and Pacific Telegraph Company, and that notwithstanding subsequent proceedings it was still the property of the Atlantic and Pacific. As that company had been consolidated with the Western Union, the title of the wire, therefore, passed to the latter company. Judge Blachford decided this point in favor of the railway company previous to 1878, deciding that the Atlantic and Pacific had no right, title, or interest in the wire.

The wires were turned over to the Baltimore and Ohio, and a large amount of business has been transacted. The change cuts the Western Union off from connection with about 50 offices, many of them being quite important. The order to show cause why the injunctions should not be continued during the pendency of this suit is returnable before Judge Barnard, at Special Term, in Brooklyn

TELEGRAPHIC

.... A company has been organized to lay a cable from Brazil to New Orleans, *via* St. Thomas, to cost $3,000,000, which will work in connection with the Bennett-Mackey cable.

.... The Bennett-Mackey Atlantic cable will be ready for public service in October. One cable is already finished, and the other nearly so. The cost will reach $7,000,000. The rate will be materially less than by the old cable.

.... At the semi-annual meeting of the Anglo-American Cable Company in London, last week, the report showed a falling off in the receipts of £13,377, compared with the first half of 1883. The report proposed the setting apart of £75,000 for a renewal fund, and the declaration of a second quarterly dividend of 17s. 6d. percentage on ordinary stock, and of 35s. on preferred stock. The chairman said that the company was about to meet with another baleful competition, but its property was in good order. The decrease in earnings was owing to the depression of trade. The report was adopted.

.... A contract was executed recently transferring the control of the telegraphic wires on the line of the New York, Ontario and Western Railroad, between New York and Oswego, from the Western Union to the Baltimore and Ohio Company. The contract took effect August 6, on which date the present contract of the Western Union expired. This new arrangement terminates a bitter struggle which has been going on for several months between the Western Union and the Baltimore and Ohio companies for possession of these wires. The Baltimore and Ohio telegraphic system gains about 100 important offices, and it is claimed that the company will now be able to reach more points in this State than have ever before been operated by any line in opposition to Western Union. Since Mr. Bates became president and general manager of the Baltimore and Ohio Telegraph Company that organization has succeeded in making favorable contracts with a large number of railroads, among them being the West Shore, Nickel Plate, New York, Ontario and Western, Cincinnati, Washington and Ohio, Ohio and Mississippi, and Gulf, Colorado and Santa Fé.

.... An injunction restraining the International and Eastern Telegraph Company from attempting to enforce the payment of a note for $15,000, given by the Bankers and Merchants' Telegraph Company, and from selling, pledging, or parting with any of the mortgage bonds of the Bankers and Merchants' Company, has been granted by Judge Bartlett, in Supreme Court Chambers. The Bankers' Company alleges that on March 29, 1884, the International Company pretended to sell it certain telegraph lines, poles, and wires between various points in the State, for which it agreed to pay $25,000 in cash and $40,000 in its first mortgage bonds. Subsequently this agreement was changed, and the Bankers' Company paid to the International Company $10,000 in cash and gave a note for $15,000, payable in sixty days. The note was secured by $30,000 worth of the general mortgage bonds of the Bankers' Company. This agreement was accepted by the International Company, but so far, it is claimed, the International Company has failed to convey any title whatever to the property. It is also claimed that the consideration of the note has failed, and that the agreement has not been ratified by a three-fifths vote of the directors of the International Company or of a majority of the stockholders. Payment of the note was refused August 2 on the ground that the Bankers' Company has received no consideration. With the understanding that the International Company was about to enforce payment of the note and to sell the mortgage bonds held as collateral, the injunction was applied for.

ELECTRICAL AND SCIENTIFIC

* * The Italian government proposes to found a central magnetic observatory at Rome, to be placed under the direction of the Meteorological Office. The government asks for a vote of 176,000 francs, in addition to an annual sum of 5,505 francs for general expenses and 11,500 francs for *personnel*.

* * The electric railway at Brighton, in England, is a success. It runs along the shore every ten minutes picking up passengers as it goes, and can be stopped, when hailed, as easily as an omnibus. Its motion is sliding and pleasant. Its capacity is apparently unlimited. It is to be extended to the western end of the Brighton Beach, and is then expected to yield a very handsome revenue to its promoters.

* * It is said that the new torpedo boat of Captain John Ericsson will be one of the most terrible of all engines of warfare. This boat, now nearly completed, will be able to overtake the swiftest vessel afloat, can elude all missiles that may be hurled at it, and will carry a torpedo which can shatter and sink the strongest ship. The torpedo differs from all others, and the firing will be either by electricity or compressed air.

* * It is claimed that one of the most efficient forms of railway electric signals, as proved by experience, is that operated on the principle of the closed or constant electric circuit, the rails being used as conductors. The track is divided into mile sections, and at one end of the section is placed a battery, one pole being connected by wire with the rails of one side of the track, while the other pole is connected by wire with the rails of the other side; at the other end of the section is placed the signal, moved by a weight or spring, the latter controlled by an electro-magnet. When the electro magnet is excited it causes the signal to take the safety position, and when the electro-magnet is demagnetized it causes the signal to indicate danger.

* * It is stated that L. G. Woolley, of Indianapolis, one of the inventors of the locomotive electric headlight, has invented a thermo-electric generator, which is believed by experts to be the beginning of a revolution in the use of the electric fluid. The generator is like a copper boiler, and stands on the frame of an ordinary sewing machine. It is operated by a coal oil lamp, and the flame of one used at night to give partial light in a sick room furnished a supply of electricity which ran a one-horse engine and illuminated four incandescent lamps. The inventor claims that he will be able to furnish motive power for all purposes in which stationary engines are used at one-twentieth of the present cost. His generator is attached to a telegraph wire running from Fleuago to Louisville, and thence by a loop to New Albany, and with the expenditure of no material except the oil in the lamps under the generator, is supplying all the electricity needed for telegraph purposes.

* * An improved thermopile, invented by Dr. G. Gore, for measuring small electromotive forces, has about 300 pairs of horizontal, slender, parallel cotton-covered iron and German silver wires mounted on a wooden frame. About 1.5 inches of the opposite ends of the wires are bent downward to a vertical position to enable them to dip into liquids at different temperatures contained in long, narrow troughs, the liquids being non-conductors, such as melted paraffine for the hot junctions, and the non-volatile petroleum, known as thin machinery oil. The electromotive force obtained varies with the temperature; a pile of 295 pairs having a resistance of 95.6 ohms at 16° C. gave with a difference of temperature of 100° an electromotive force of .7729 volt, or with 130° an electromotive force of 1.005 volts. Each element, therefore, equaled .0000262 volt for each degree Centigrade difference of temperature. It can measure the $\frac{1}{32857}$ part of a volt, but for higher electromotive forces than a volt several of the piles must be connected in series.

* * One of the features of the Philadelphia Exhibition will be a display of electrotypes of some of the rare coins exhibited in the British Museum. The fac similes of these ancient relics were presented to the American Numismatic and Archæological Society of New York, and by them sent to the Electrical Exhibition in that city. The coins will be arranged in seven cases, showing historical and geographical advances made in the ancient art of coinage from B. C. 700 down to the Christian era.

Arranged in the compartments the display will be as follows:

I. Circa B. C. 700–480. Period of archaic art, ending with the Persian wars.

II. Circa B. C. 480–400. Period of transitional and early fine art to the end of the Athenian supremacy.

III. Circa B. C. 400–336. Period of the finest art age of the Spartan and Theban supremacies.

IV. Circa B. C. 338–280. Period of later fine art. Age of Alexander and Diadochi.

V. Circa B. C. 280–190. Period of the decline of art. Age of the Epigorii, etc.

VI. Circa B. C. 190–100. Period of continued decline of art. Age of the Attalids.

VII. Circa B. C. 100-1. Period of late decline of art. Age of Mithradates the Great and of Roman Dominion.

Each of the seven compartments is divided horizontally into three geographical sections, containing the coins of Asia Minor, Phœnicia, Syria, etc., and Egypt, Northern and Central Greece, the Peloponnesus, and the islands of the Ægean and those of Italy, Sicily, the southern shores of the Mediterranean and Western Europe.

* * "In 1876, Charles T. Chester introduced in New York, under the name of 'magazine battery,' the De la Rive peroxide of lead cell. This element is remarkable for its high electromotive force, and, among single fluid cells, for its constancy of action. The depolarizing substance is expensive; and, as put upon the market, it contained traces of nitric acid, which proved destructive to the zincs. Notwithstanding the latter defect, the cell exhibited incontestable merits. Two cells were tested In both the negative plate consisted of a carbon plate embedded in peroxide of lead contained in a porous cup. This cup was 3 inches in diameter and 5.5 inches high. The positive plate was the common Leclanche cylinder of zinc, ½ in. in diameter, and 7 in. long. They were placed in a cylindrical glass cell, 4 in. in diameter and 6 in. high, half filled with fluid, which for one cell was dilute sulphuric acid (1 part of acid to 14 parts of water), and for the other cell a saturated solution of sal-ammoniac. The internal resistance of the former at the first closing of the circuit was 1.7 ohm, and at the end of the trial 7.5 ohms. These cells were allowed to stand for a few days without closing the circuit, and the change in electromotive force was noted by Law's method as follows: Feb. 19, 1876, acid cell, 2.305 volts; sal-ammoniac cell, 1.800 volts. Feb. 24, acid cell, 2.128 volts; sal-ammoniac cell, 1.664 volts. Feb. 25, acid cell, 2.057 volts; sal-ammoniac cell, 1.689 volts. Feb. 26, acid cell, 1.994 volts; sal-ammoniac cell, 1.642 volts. They were then placed at work continuously for five days. After a rest of two days, and a re-amalgamation of the zincs, which had begun to suffer, the circuit was again closed, the electromotive force being 1.580 and 1.490 volts respectively. At the end of the thirty-third day both cells were exhausted, new zincs and fluids being required. About a minute after the circuit was finally broken, the electromotive force of the acid cell was .471 volt, and of the other, .803 volt.

* * Much interest is felt among experts and others who are connected in the manufacture and the use of steam-power apparatus in the successful working of the new method of developing steam power which is being introduced by the New England Motive Power Company of this city. The apparatus is in constant use at the works of the Hollowell Granite Company on Medford street, in the Charlestown District. It has been in use there some ten weeks, and gives entire satisfaction in respect both to the economical development of power and the saving of fuel, *i. e.*, about 50 per cent. of coal is saved, and the same amount of power is now developed by the use of one boiler of 50 horse-power that formerly was produced by this boiler and another one of 30 horse-power. The new method is not, however, wholly a matter of improved apparatus. The chief factor in the gain that is made consists in the mingling of a certain proportion of methylic spirits, or pure wood alcohol with the water from the boiler. The proportion has been varied in different experiments, but the engineer of the granite company has derived results most satisfactory on the whole by using 10 per cent. of the spirits. The gain comes from the element of alcohol. There is no special virtue in this particular kind of alcohol, and the ordinary alcohol of commerce would serve as well, and might be preferred if it were as cheap, The advantage is that the admixture of alcohol permits the water to be vaporized at a considerably lower degree of temperature, namely, at 160 degrees of Fahrenheit, instead of, in case of water simply, 212 degrees. The apparatus does not require any different boiler construction, but it is an outside attachment which may be adjusted to any boiler. By means of it the compound of water and alcohol may be used over and over again during a period of weeks, so that the cost for alcohol after the first outlay is very slight. The apparatus consists mainly of a condenser in combination with a three-cylinder pump. One cylinder forces the exhaust steam into the coils of the condenser, and another carries outside the coils a volume of salt water drawn directly from the dock alongside the engine house. The third is the vacuum cylinder, which is of service in returning the condensed vapor to the boiler. This vacuum cylinder serves also in another way by relieving the direct internal pressure of boiler, so that while under the former method a pressure, as indicated by the steam gauge, of 65 pounds was employed, 45 pounds is now found to be sufficient. Another advantage appears in the use of the alcoholic combination in the gain of time required for getting up steam, but about half the time formerly required being now needed. A series of practical tests of this invention—which has been patented here and abroad—is now in progress at the Navy Yard in Washington, and a report, giving results measured with scientific accuracy, will probable appear at an early date. The inventor of the process is Mr. William L. Lowrey, of Boston. Mr. W. S. Chamberlin, formerly general agent of the Hartford Steam Boiler Insurance Company, is the manager.

The Electro-Chemical Equivalent of Silver.

In the *Journal de Physique* for July, M. Mascart has an article in which he gives an account of recent experiments undertaken by him to determine the weight of silver deposited or dissolved during one second by a unit of current. Some few months ago he arrived at the conclusion that the quantity was 11.24 m. g. Kohlrausch gives 11.36, and Lord Rayleigh 11.19. Since these determinations F. and W. Kohlrausch, by a fresh series of experiments, have found it to be 11.183, and Lord Rayleigh has recently, March, 1884, made it 11.18. Accordingly, M. Mascart thought it necessary to re-verify his calculations, and acknowledges that he was deceived. Without going into his calculations, we may say that he now gives his result as 11.156 m. g. The chemical action of one ampere per second, or of one coulomb will, therefore, be, says M. Mascart:

According to Kohlrausch, 1.1183 m. g. of silver dissolved.

According to Rayleigh, 1.118 m.g. of silver dissolved.

According to Mascart, 1.1156 m.g. of silver dissolved.

Electro-Magnetic Ore Dressing.

A few years since, the announcement was made through the technical press that a system of electro-magnetic ore dressing had been tried in Germany. The plant which has now been at work for three years at the Friedrichssegen mine, near Oberlohnstein, has been recently described in greater detail by Herr Otto Heberle, at a meeting of the Verein Deutscher Ingenieure. The Friedrichssengen mine produces ore containing a good deal of iron ore and zinc blende, which are difficult to separate, because their density is nearly the same. Two classes of ore are mined, cobbing ore, from which some pure salable ore is separated by hand sorting, and smalls. That part of the cobbing ore that is rejected in sorting goes to the electro-magnetic separators, while the smalls are dressed in the usual manner. Middlings containing blende and iron ore are obtained also in this dressing, and they too go to the electro-magnetic plant. The material for that process obtained by sorting ranges in size from 40 to 120 millimeters, while the ore from the ordinary dressing plant is 6-millimeter stuff. It is worked by first roasting, separating by means of the electro-magnets, and then jigging.

The object of the roasting is to prepare the material for the subsequent process by converting the iron into magnetic oxide. The picked lump ore is roasted in a shaft kiln, with coke dust as fuel. The consumption of fuel is slight on account of the sulphur in the blende, not being greater than 110 pounds to 8 tons of ore, which are daily put through one furnace. The furnace requires the labor of two men. The roasted ore goes to a rock breaker and to a pair of rolls below it, which reduce the rock to a 5-millimeter grain, and deliver it to an elevator that takes it to the electro-magnets.

The fine middlings obtained in the wet dressing are worked in one reverberatory furnace with a hearth 12 feet wide and 38 feet long, provided at each side with a fireplace, 5 working doors, and a discharge opening, and in one smaller reverberatory, the hearth of which is 6 feet wide and 22 feet long, and which is provided with one fire place, two working doors, and a discharge opening. Roasting takes an hour and a half. These two furnaces have a capacity of from 18 to 20 tons in twenty-four hours; but of course the cost of fuel and labor is much greater, being fully three times as large as that of roasting the lump in kilns. After being roasted, the ore is spread out on a cooling floor, is then passed over the screens to get out sintered lumps, and is then delivered by a bucket elevator to the hopper into which the crushed and calcined lump ore goes. In this hopper, the ores are put through a screen with 4-millimeter mesh, the fines falling through chutes to the magnetic separators, while the coarse is crushed by a small set of rolls.

The dressing is done by 16 electro-magnetic apparatus arranged in sets of four in pairs above one another. The upper pair receives the ore from the chutes, and partially separates the blende from the iron. The products obtained are worked over once more in the lower apparatus. They are:

1. A mixture of blende and quartz.
2. Iron ore.
3. Blende middlings.
4. Iron ore middlings. The middlings are treated over again.

The Cleveland Electric Street Cars.

The Cleveland *Herald* says that the machinery for a second electric street car is in place, and the car will be running in a few days, when the interesting experiment of passing two cars—one on a switch and the other on the main track—will be tried. The mechanism to enable this to be done is said to be very simple. It is an automatic arrangement that reverses the current, much as the electric currents are switched about on the keyboard in a telegraph office. Mr. Knight has no fear but the two cars will run as well as a single one now does. It was not long ago when one electric light was all that could be burned on a circuit. Now eighty

lights are burned with ease, and, as surely as more than one light on a circuit will burn, so surely more than one car will run. It is difficult to understand how the car now running on the Garden Street extension could be improved. It ran up and down the line yesterday at a speed often exceeding the fastest time of a street car team. A test of the power of the motor was made the other day, when a second coach was attached to the electric car, and 100 passengers were drawn with ease. One change in the mechanism of the car will be made. The full electric current is coursing through the machine even when the car remains stationary, and if it stands any length of time the motor becomes highly heated. When the car is running, the motor is not heated to any great extent. The new device will enable the operator to turn off the current, and thus relieve the motor when the car stops.

It was amusing yesterday to watch the passengers who boarded the car. Some took the invention as a matter of course, while others, and especially the ladies, evinced great curiosity, and were not at all alarmed when the trap-door over the box containing the motor was opened, and many-colored electric flashes played around the machinery. The electric current that propels the car has sufficient force to instantly kill the person who handles the wire carelessly, and Mr. Knight states that he has sustained several shocks. He works about the machine with great caution. There cannot be the slightest danger to the passengers, however.

An unexpected drawback is the fact that half the horses that pass the car are frightened by it. There is nothing unusual in the appearance of the car, and it makes no noise besides the whirr of the motor, running at about 1,000 revolutions a minute. The whirr cannot be heard outside the car, but the sight of the vehicle moving off with apparently nothing to propel it is a source of constant surprise to a horse. Even old plugs were frightened, and one passenger opined that the horses, jealous of a loss of business, had combined to express their disapproval of the invention.

As showing the financial success of the invention, Mr. Knight said: "The aggregate expense of running two cars will be $5 a day. From eight to twelve horses to a car are required on a street car line. Two electric cars will displace twenty-five horses on this road, and the daily expense of the animals is about $13. The life of a street car horse is about three years, while a motor will last fifty years. In fact, there is little about it to wear out—so little that none of the electric light machines, which have been put up by the Brush Company, have ever required repairs, and the question of wear is hardly taken into account."

The Recent Decision of Judge Shipman.

The Brush Electric Company has issue the following circular:

"It will, no doubt, surprise our agencies and lighting companies to learn that a suit of this company against the U. S. Electric Lighting Company, which has been before the court for a long time past, has been decided by Judge Shipman in favor of the defendants. The decision was a great surprise to us, and we have every reason to believe it was fully as much a surprise to the defendants. There were a number of intricate points in the case over which great labor was spent by both sides, all of which were decided in our favor, and the case finally turned on a single point, which was a very simple one, and we supposed entirely clear. In 1876, two years prior to the date of Mr. Brush's patent, a man named Hayes made a lamp containing a clamp somewhat resembling the clamp used in the Brush lamp, but used quite differently. The lamp was a failure, and after a number of attempts to make it work properly, the clamp was taken off, thrown into a scrap box, and the whole matter dropped. No other lamp was ever made with the clamp, and as this one had never been regarded as successful, either by the maker or any one else, until it was thought that it could be made use of to beat us, and was, as we believed, purely experimental, we treated it as an abandoned experiment, and, therefore, no anticipation of Mr. Brush's invention, which was entirely successful from the start. Judge Shipman decided, but apparently after serious doubt, that it was not strictly an abandoned experiment, and on this point alone decided the case against us. The case will be at once appealed to the United States Supreme Court, and followed up to the end.

"The only issue involved in the final hearing of this suit was the lifting and feeding clamp in the lamp. We have other suits still pending against the agents of the United States Company, or users of its apparatus, on other patents that are of much more importance than the one recently decided. We also have a number of other suits on various patents against other systems of lighting, as will be seen by the accompanying list, and infringers will do well to bear in mind that so far only a single one out of more than forty Brush patents has been judicially declared invalid, and we propose, as heretofore, to prosecute all infringers who disregard our rights.

"Suits are now in progress in various United States Circuit Courts against users of infringing apparatus covered by patents other than the one passed on by Judge Shipman. Among these are suits against users of the following systems:

"The United States (Weston).
"The Fuller Electrical Company.
"The Excelsior Electric Light Company, (Arnoux & Hochhaussen).
"The Schuyler Company.
"The Van Depoele Company.
"The Boulton Carbon Company.
"The Pittsburgh Carbon Company.

"Suits are also in preparation against other infringers, including the Thomson-Houston System, which infringes some of our most important patents upon the dynamo machine.

"The above suits include many different patents, all of which are controlled by us.

THE BRUSH ELECTRIC COMPANY.
"Cleveland, Ohio, July 22d, 1884."

Belts for Electric Lighting.

All who have had experience with electric lighting know how much depends on a good belt. The dynamo, lamps, and connections may be all right, but if there be any irregularity in the belt it will show itself in the light, to the great injury and discredit of the latter. Messrs. Lawrence & Herkner, of this city have met this want by supplying an endless belt, made from choice leather, with no rivets or lacings, all joints being made with a patent cement, which neither water nor oil will affect. For the great plant of the Edison Electric Light Company at the Louisville Exposition the firm named manufactured over 1,500 feet of their special electric light belting, from 12 to 14 inches wide, and from the start until the close of the Exposition these belts worked in the most satisfactory way. Messrs. Lawrence & Herkner justly prize the following letter from the then general manager of the Edison Company, which certainly speaks for itself:

LOUISVILLE, KY., Aug. 25th, 1883.

Messrs. Laurence & Herkner, New York: The belting purchased from you for use in connection with our electric light plant at Southern Exposition at Louisville, Ky., gives perfect satisfaction; could not ask for anything better. Our plant, being the largest in the world, attracts much attention, and the smooth and true running of the belts is much admired. Yours respectfully,

M. F. MOORE, Gen'l. Manager,
The Edison Company for Isolated Lighting of New York.

The secret of the great success of the firm in making this special belting lies in the care used in selecting the leather, so as to have uniformity of texture and thickness; in the skill shown in treating it so as to render it pliable and waterproof; in the ingenious method of making cemented joints, which are so perfect that the eye does not readily detect them, and in making each belt complete and endless before it leaves the shop, ready to fit the exact work for which it is intended. The firm has lately made a 28-inch belt for the Jersey City Electric Light Company, and a 50-inch belt for the Capitol at Albany.

Incandescent Street Lighting in Circleville.

To the Editors of the Electrical Review:

Knowing your interest in the progress of electric lighting, I take pleasure in informing you of the entire success of a new application for the Edison incandescent lamp; I refer to street lighting. Last night, for the first time, all the streets of this town were lighted by Edison lamps, and by them only. The lighting proved satisfactory in every respect, and the experiment proved a grand success: Circleville is, I believe, the first town in the world to be lighted s lely and entirely by incandescent lamps. There are some ninety lamps in all in the town, of which number sixty are of 32 candle power, and the remainder of 16 candle power. The town is wired in six separate and distinct circuits, all of which are controlled at the central station. The lamps are suspended over the center of the streets under a special form of reflector designed for the purpose, which also protects the lamp from rain, snow, etc. Circleville is a town of over seven thousand inhabitants. The streets have previously been lighted by gas. The lighting extends for over half a mile in all directions from the central station, and in several instances for more than a mile. All the lamps are burning at their normal candle-power, and the streets are brilliantly lighted. We also have a contract for lighting Middletown, Ohio, where we will replace the Brush tower system. The work is half completed there now, and the light will be turned on for the first time in a few weeks. Our central stations at Tiffin, Piqua, Middletown, and here are all doing nicely, and we have all the work we can attend to.

Yours, very respectfully,
H. WARD LEONARD.
Circleville, Ohio, Aug. 8th, 1884.

—— The following account of the electric light at Turin is translated from an article which appeared in one of the leading Italian newspapers: "It is impossible to keep our eyes shut any longer to the brilliant and numerous applications of electricity for illumination. The electric light as a source of illumination is undoubtedly destined to supersede gas. The incomparable superiority of this system of illumination over all others that are known to us up to the present time is just now beginning to be appreciated by us, and whilst remembering that it may be still further perfected by study and careful research, the experiment at Turin makes us now entirely in favor of lighting the establishments and streets of the town by this new method of illumination. At the instigation of G. Doll, Esq., director of the Establishment Gruber, the large square of Turin is lighted magnificently by the electric light, to the general satisfaction and pleasure of the inhabitants. The Crompton dynamo machines, driven by two turbines, were placed in the weaving mills of Messrs. Gruber. Swan incandescent lamps, sixteen of 16 candle-power, were used to light the square, while Crompton lamps of a power of 6,000 candles each were affixed to the four corners of the tower of the municipal buildings. The light given by these lamps was most intense, white, and constant, and has been likened to a splendid full moon. Turin now appears to have shaken off the apathy and laziness which seemed to have grown upon it, and one may almost prognosticate that it is the future Manchester of Italy, which name was applied to Biella by Cavour. The plentiful supply of water-power favors immensely its development. It is understood that if Turin adopts the electric light to illuminate its streets and private houses, Biella will probably follow suit."

It is stated that the Office of Works for the city of Vienna has approved of a specification for the lighting of portions of the new Rathhaus with electric lamps. It is to receive the sanction of the magistrates and common council and then tenders will be invited.

ELECTRIC LIGHT NEWS

—— The Brush Electric Light Company have just put in operation a large plant in New Orleans.

—— Investigations concerning the effect of different forms of artificial illumination on the health have shown that the tallow candle is the most unwholesome agent, and the electric light the best. The incandescent electric lamp produces only about 1-30 as much heat as the tallow candle, while it gives out no carbonic acid or water. One gas jet in a room is said to vitiate the air as much as six persons.

——It is said that the cost of electric light for illuminating cities, as compared with gas, has been computed by Hartford, Conn., where arc lights have been in use for about a year. The report states that each electric light in use displaces six and one-half street gas burners, besides giving at the same time at least ten times as much light. The gas lamps cost $35 per burner per annum, kept burning 326 nights in the year, while for the electric lights sixty-five cents a night is paid. The electric light being equal to six and one-half gas burners, a saving of $15.60 per lamp per year is effected by the use of electricity, besides the cost of lighting and extinguishing the gas lamps.

—— Dr. R. W. St. Clair, of Brooklyn, has connected a small incandescent lamp with a portable electric battery. The apparatus is intended to be used in surgery for the illumination of cavities in the body. Many operations in surgery are difficult or impossible on account of the impossibility of lighting up the cavity to be operated upon. With this instrument, combined with the laryngoscope, the throat may be explored to a greater depth than heretofore has been deemed possible. The lamp will also be very useful in dental surgery. It is very small, hardly larger than the head of a pencil. It has even been proposed to use the light for the purpose of photographing cavities of the body. The whole apparatus is about the size of a cigar box.

—— The *Waterbury American* says that about 8 o'clock Monday night the gas lights about the center assumed a yellowish hue, and the jets began to cast a shadow themselves, under the powerful glow of the nineteen electric lights then in operation. One of the lights on the green had been improperly arranged, so that only the one in the fountain basin shone forth. But that was enough to convert the green into a kind of fairy land, with the words "Thomson-Houston System" flitting about on the ground, in shadow from the words on the great globe. Several of the stores on Bank and other streets reveled in the same glow. It was a kind of transformation. People looked to see the lights flicker and sizzle, but they looked in vain. The great day so long looked for had come. The management, which had kept everything so "dark," literally and slangily, had waited until they were sure of success. As previously described, there are two engines of fifty horse power each, with a 100 horse-power boiler, and three dynamos with twenty-eight lights each, with another coming. The dynamo makes 860 revolutions per minute to the engine wheel's 280, thus generating a terrible force. On the wall are two instruments which act with one on the dynamo and regulate the flow of electricity, thus preserving a steady light—an arrangement of the most meritorious kind, and one which belongs to no other system. On the opposite wall are the switches by which any current for any building can be turned off. Of the forty subscribers on the list at present, only nineteen received the light last night. But all will at once be in working order, and the list is increasing. The cost is $16.50 per month for one midnight circuit lamp the year round, or $15 each for two.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING AUGUST 5, 1884.

302,883 Underground pipe or conduit for electrical conductors; George H. Benjamin, Short Hills, N. J.

302,935 Fire-alarm system; Edgar F. Phillips and James F. Land, Detroit, Mich.

302,960 Electric lamp; Elihu Thomson, New Britain, Conn., assignor to the Thomson-Houston Electric Company.

302,961 Focussing electric arc lamp; Elihu Thomson, New Britain, Conn., assignor to the Thomson-Houston Electric Company.

302,962 Electric arc lamp; Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut.

302,963 Regulator for dynamo-electric machines; Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut.

302,968 Safety device for electric circuits; Edward Weston, Newark, N. J., assignor to the United States Electric Lighting Company, New York, N. Y.

302,976 Dynamometer; Cyrus F. Brackett, Princeton, N. J.

302,980 Fire extinguisher and alarm; Charles E. Buell, New Haven, Conn., assignor to the Buell Electrical and HydraulicManufacturing Company, of New York.

303,020 Electric arc lamp; John F. Kelly, Little Falls, N. Y., assignor to the Parker Electric Manufacturing Company, same place.

303,052 Transmitter for telephone time systems; Charles W. Ruehle, Detroit, Mich.

303,057 Engraving machine; Jakob Schweizer, Soleure, Switzerland.

303,109 Fire-alarm box; Elias Bliss Birge, St. Paul, Minn.

303,202 Incandescent electric lamp; Clinton M. Ball, Watervliet, N. Y.

303,237 Battery for generating electricity; Gregoire George Skrivanow, Paris, France.

303,245 Electric arc lamp; James J. Wood, Brooklyn, N. Y.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40.00. Various other Foreign patents may also be obtained.

Any of our readers having copies of the old REVIEW of the TELEGRAPH AND TELEPHONE, dated March 15th, 1882 (No. 3), not specially needed by them, will confer a great favor upon us by sending them to this office, for which we will remit twenty-five cents per copy. DELANO & COMPANY,
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MITCHELL, VANCE & Co., New York, manufacturers of Electroliers and Combination Fixtures, for both gas and electric light.

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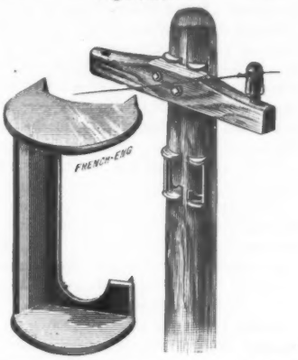

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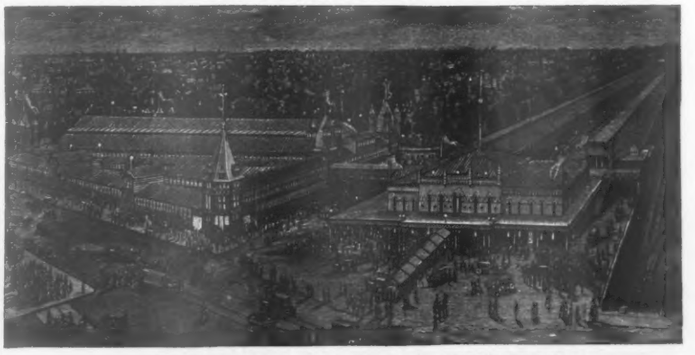

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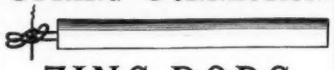

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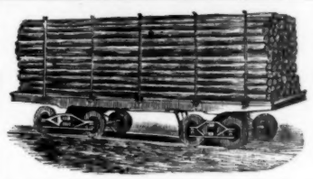

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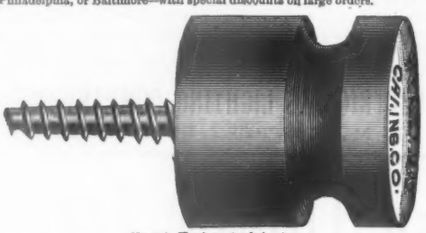

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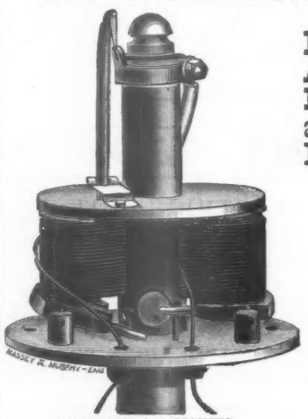

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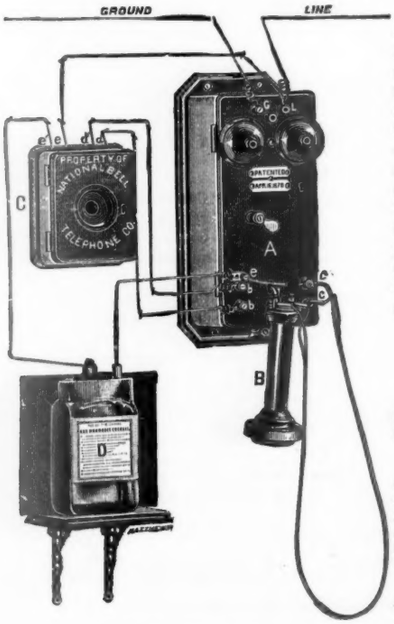

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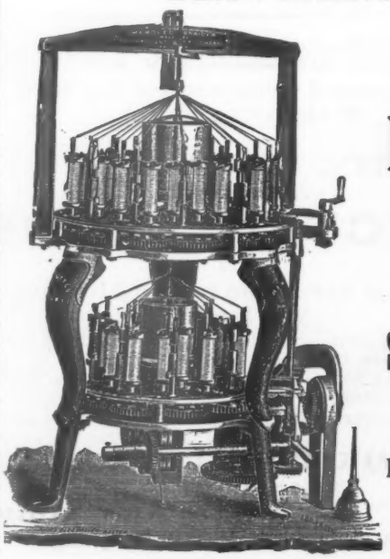

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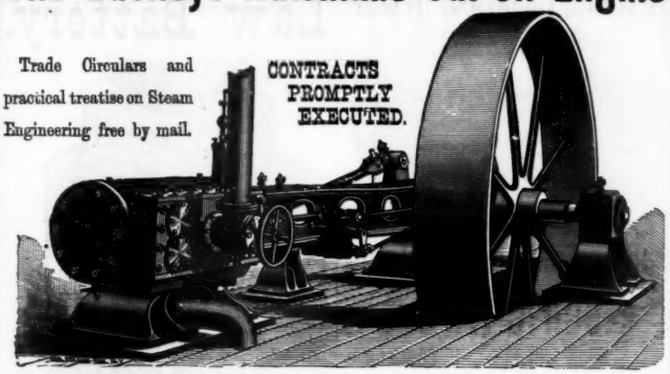

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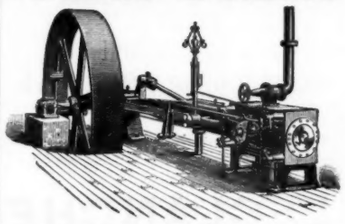

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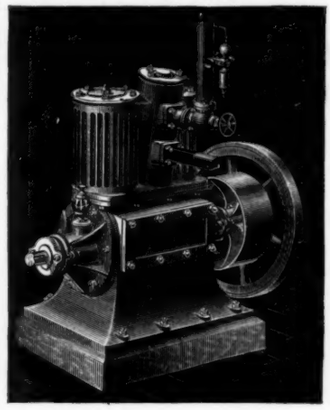

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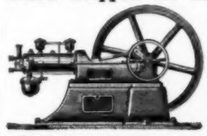

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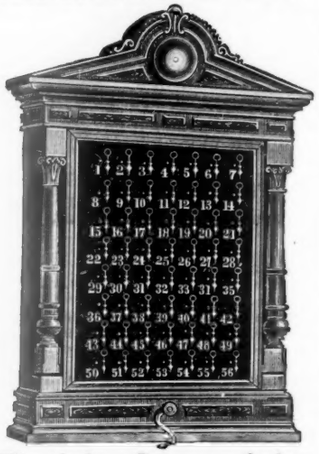

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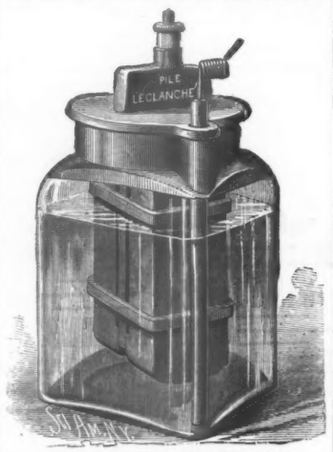

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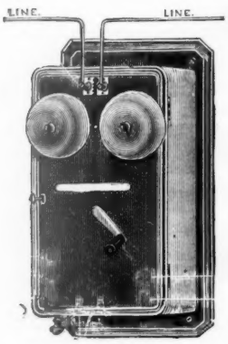

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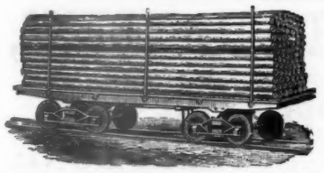

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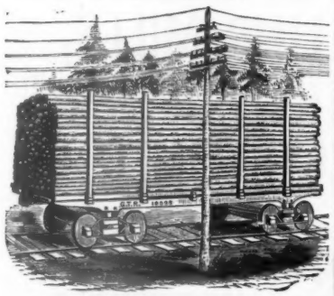

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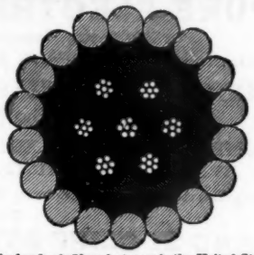

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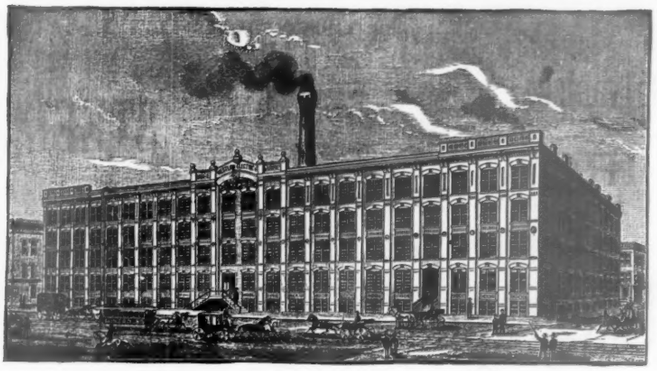

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